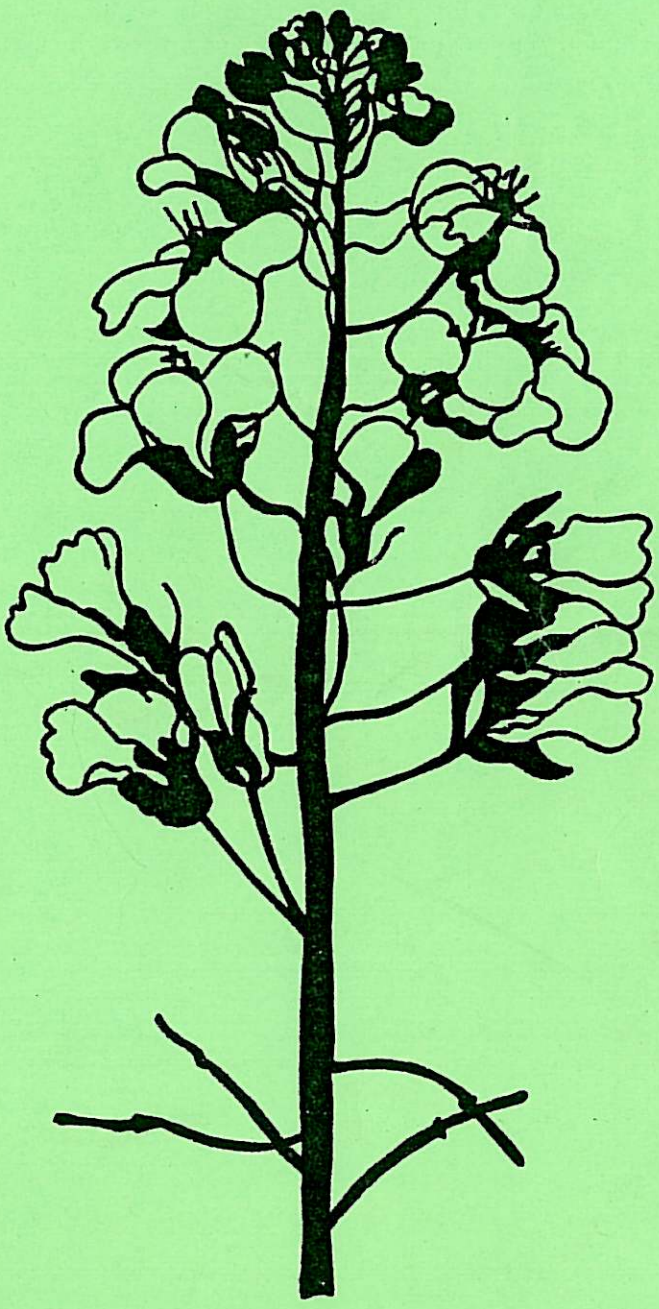
CRUCIFERAE NEWSLETTER No.4



November 1979

EUCARPIA

Editorial

Cruciferae Newsletter No. 4 has been produced in the form that was used for the preceding editions, as these have been generally well received. The Editors would like to thank all those who have expressed their appreciation as well as those who assisted by sending contributions.

The number of contributions is, however, much reduced this year, possibly due to the occasion of two major conferences on brassicas (the American 'Crucifer Improvement Conference' and the Eucarpia Conference 'Cruciferae 79'). These meetings have evidently diverted a number of potential contributors away from the Newsletter. It is to be hoped that, for the sake of its continuing health, the Newsletter will be better supported in 1980. It must be the responsibility of readers to ensure that this is so.

The Editors are willing to consider any suggestions for ways in which the Newsletter can be improved by the inclusion of material of different kinds. They welcome the extension of the Newsletter to cover the 'Working Group on the Taxonomy and Evolution of the Tribe Brassicae'.

Once again the Editors are pleased to acknowledge the financial contribution by the Board of the National Seed Development Organisation, Ltd., of Newton Hall, Newton, Cambridge, U.K., towards the costs of production and distribution. NSDO is the marketing agency for the state-aided plant breeding stations of the United Kingdom.

The problems of obtaining financial support to continue production of the Newsletter were discussed at the Eucarpia 'Cruciferae 79' conference in Wageningen. One suggestion was that recipients should pay for the Newsletter but a considerable part of any charge would be absorbed in bank fees and the administration would become more complex. Another suggestion was that we should seek support from seed companies and we intend to do this for issue No. 5. Any alternative suggestions would be welcomed. The financial deficit on the production of the present issue will be met by the generous transfer of a surplus from the 'Cruciferae 79' conference.

Contributions to Newsletter No. 5 should conform to the instructions given on Page 52; reminders will be dispatched in August 1980. The Newsletter will be sent free to contributors, to those who request it in advance and to all who have received Newsletter No. 4

Dr A.B. Wills,
Scottish Horticultural
Research Institute,
Mylnefield,
Invergowrie,
Dundee, Angus, DD2 5DA,
Scotland, U.K.

Mr R.N.H. Whitehouse,
Scottish Plant Breeding
Station,
Pentlandfield,
Roslin,
Midlothian, EH25 9RF,
Scotland, U.K.

ANNOUNCEMENT

A WORKING GROUP on the TAXONOMY and EVOLUTION of the TRIBE BRASSICEAE

By obvious reasons, most of the basic or applied research involving the tribe Brassiceae has been focused in the past either on the genus Brassica or on a few close allies such as Raphanus, Sinapis, etc.

In the past few years, however, a tendency to pay increasing attention to other genera is very apparent. The taxonomy of the tribe (51 genera) is rather loosely established, and much is to be learned on the evolutionary relations between its members. The subject is of high interest per se and also by its incidence into our knowledge of the crop species themselves.

During the Crucifer conference in Piccadilly (1974) the constitution of an informal working group on Cruciferae "with emphasis in the tribe Brassiceae" was proposed, but it soon became apparent that such a group was not feasible without a mean of communication (a Newsletter or so) for the members.

That problem is now solved with the existance of the "Eucarpia Cruciferae Newsletter" where several articles widely concerning the tribe Brassiceae or crucifers of other tribes have been already published. The editors have kindly agreed to admit a flow of articles of this type, as well as relevant notes or announcements when necessary. Short review articles (1-2 pages!) would also be most useful to update specific aspects.

The objectives of this group would not be ambitious, at least for the time being : just to know each other and to keep in contact through the Eucarpia Cruciferae Newsletter and maybe through an automatic exchange of reprints. For a future, meetings or some other forms of cooperation could be envisaged.

Tentatively, any activity that might contribute to improve our knowledge of the taxonomy and evolution of the tribe Brassiceae, would be within the scope of this group. Whether this tentative definition is taken in a wide or in a nerrow sense, and whether or not the group should be enlarged to include the whole Crucifer family, are open questions on which it would be useful to hear reactions.

If you are interested, please write to me with: 1) your name and full adress, 2) the taxonomic group or groups where you are interested, 3) the aspects -morphology, caryology, phytochemistry, etc. - you are interested, 4) your degree of involvement, i.e. you are actively working, you are planning to work, you have worked in the past but wish to keep in touch, etc., 5) when appliable a list of your publications on the subject, and 6) any opinion or suggestion you may have in relation to the group.

César Gómez-Campo (Prof.)
Escuela T. S. Ing. Agrónomos
Univ. Politécnica. Madrid 3, Spain

Announcement

A book

"BRASSICA CROPS AND WILD ALLIES - Biology and Breeding -"

edited by S. Tsunoda, K. Hinata and C. Gómez-Campo, is now in preparation. This will be published coming February from Japan Scientific Societies Press, Tokyo. pp. 360, ¥5,500. (estimate).

Contents

I. SYSTEMATICS: 1. Morpho-taxonomy of the Brassiceae (C. Gómez-Campo), 2. A variation study of subtribe Brassicinae by principal component analysis (Y. Takahata and K. Hinata), 3. A check list of chromosome numbers in the tribe Brassiceae (C. Gómez-Campo and K. Hinata), 4. Meiotic analysis of some species and genus hybrids in the Brassiceae (D. J. Harberd and E. D. McArthur), 5. Genome analysis in Brassica and allied genera (U. Mizushima),

II. WILD AND CULTIVATION: 6. Eco-physiology of wild and cultivated forms in Brassica and allied genera (S. Tsunoda), 7. The wild forms of the Brassica oleracea group (2n = 18) and their possible relations to the cultivated ones (S. Snogerup), 8. Differentiation of Brassica crops in Asia and the breeding of 'Hakuran' a newly synthesized leafy vegetable (S. Nishi), 9. Cruciferous oil seeds in India (S. Prakash),

III. BREEDING: 10. Polyploid breeding in Europe (G. Olsson and E. Ellerström), 11. Interspecific and intergeneric hybridization breeding in Japan (H. Namai, H. Sarashima and T. Hosoda), 12. Male sterility and cytoplasmic differentiation (T. Shiga), 13. Self-incompatibility in Crucifers (K. Hinata and T. Nishio), 14. Variation in oil content and fatty acid composition among seeds from the Cruciferae (P. R. Kumar and S. Tsunoda), 15. Biosynthesis of seed oil and breeding for improved oil quality of rapeseed (G. Röbbelen and W. Thies), 16. Variation in rapeseed glucosinolates and breeding for improved meal quality (G. Röbbelen and W. Thies),

IV. PRESERVATION: 17. Seed storage and viability test (K. Takayanagi), 18. Dormancy and seed germination (N. Takahashi and Y. Suzuki), 19. Preservation of genetic resources (S. Tsunoda, K. Hinata and C. Gómez-Campo).

S. Tsunoda
Fac. of Agr., Tohoku Univ.,
Sendai 980, Japan

REPORT ON THE EUCARPIA CONFERENCE "CRUCIFERAE 1979"

Hille Toxopeus and Nico van Marrewijk
(for the Organising Committee)

The Conference was held in the International Agricultural Centre, Wageningen, 1 - 3 October, 1979 and was made up of 98 participants: 34 Dutch, 23 British, 17 German, 10 Scandinavian, 6 French and 8 from Italy, Poland, Taiwan, USSR, Canada; 50 scientists from private firms and 48 from Government or semi Government Institutions; 50 of them involved in horticultural crops and 48 in agricultural crops.

The texts of 19 papers were received in time for printing a pre-conference edition of the Proceedings. The texts of 6 papers submitted later were reproduced and issued during the Conference. All papers will be printed in a post-conference edition of the Proceedings in January 1980; the procedure for ordering copies is stated at the end of this report.

Twenty five papers were read, grouped in sessions with the following themes: Interspecific crosses (3 papers); The new oil-seed rapes (3); Gene centres and History of domestication (2); Flowering induction and control of Mating system (7); Diseases, Disease resistance, screening methods (7); Miscellaneous papers (3). The discussion of papers was less than lively on the first day but there was more activity during the next two days.

A lively reception was held in the SVP (Foundation of Agriculture Plant Breeding) building on the evening of 1 October. On this occasion the Clubroot Working Group met briefly to discuss the proposed agenda for meeting on Thursday morning 4 October. Later during the evening about 50 participants interested in starting a working group on genetic conservation of Crucifer crops got together and had a somewhat chaotic discussion on this issue, lasting about three quarters of an hour. Summing up: there was a strong feeling that a Group concerned with Crucifer germplasm conservation in Europe must be established now. This group of crop specialists is not going to try to create its own gene bank, it would use facilities of existing Gene Banks, the liaison with which could be very productive. Toxopeus was requested to approach Conference participants to become members of this Genetic Conservation Group during the course of the Conference. This was done and the Group had its first meeting on Wednesday evening, 3 October; a report is printed elsewhere in this issue of the Cruciferae Newsletter. The afternoon of the second day was pleasantly spent (thanks to the beautiful weather) by visiting two demonstration fields reached via a 'scenic' route. That evening we enjoyed the Conference dinner.

The Conference was wound up between 15.30 and 16.00 on the following day. The provisional membership of the "Crucifer Genetic Conservation Group" was announced. A message drafted by

Drs Kjellquist and Lamberts for the IBPGR (International Board for Plant Genetic Resources) and proposed to be adopted by the Conference was circulated, read and discussed. The Conference decided to delegate the matter for consideration and possible rephrasing to the newly formed Genetic Conservation Group. (Report elsewhere in this issue).

Copies of the Post Conference Proceedings can be ordered by payment of Dfl. 30, -- (Dutch guilders, postage included) on the ABN-bank account nr: 53.91.28.104 (latest 31-12-1981) of Eucarpia-Cruciferae 1979, c/o PO Box 117, 6700 AC Wageningen, The Netherlands.
A copy will only be sent after receipt of the sume of Dfl.30,-- on the above account.

Hille Toxopeus

Nico van Marrewijk

THE 'EUCARPIA CRUCIFER GENETIC CONSERVATION GROUP'

Hille Toxopeus, coordinator

The goal of this working group is to try to prevent the further erosion of germplasm of Crucifer crops in the European (Eucarpia) context.

On Wednesday evening, 3 October, the following 14 people sat together in one of the conference rooms of the IAC at Wageningen in the inaugural meeting of the above group:

Peter Crisp, NVRS, Wellesbourne; Mats Gustafsson, Swedish Seed Association, Hammenhog; Fritjof Heyn, Saatzucht Spath, Seehof, FRG; A. G. Johnson, NVRS; Roland Jonsson, Swedish Seed Association, Svalov; Nikolay Krasheninnik, Institute for Vegetable Crop breeding, Moscow; Jan Krzymanski, I.H.A. Roslin, Poznan; Karl-Alfred Lein, von Lochow-Pethus, Nordhorn, FRG; Bill Macfarlane Smith, SPBS, Scotland; Peter Mattusch, BBA, Hurth, FRG; Krien van der Meer, IVT, Wageningen; Hille Toxopeus, SVP, Wageningen; Gunnar Weiseth, Agricultural University Norway; Tony Wills, SHRI, Dundee.*

The process of the formation of the group started in October 1978 with a question in the first circular concerning the organisation of the 'Cruciferae 1979' Conference. The question was whether or not (yes or no) the prospective participant to the Conference was ... 'interested in the idea of getting a Cruciferous crops gene bank organised somehow'; and whether or not he would be interested to participate in a working group. Over 75% (of 104) returns replied they were interested and 43 were interested to participate.. So, along with the second Conference circular, was enclosed an Annex (no 3) out of which I quote the following:

' ..... This issue is obviously a common concern, and we would be relieved to take practical direct action: ..... Action on our part is natural and proper because we are the people directly concerned and involved. However, equally common, each of us lacks the time and facilities to delve deeply into this issue, or to afford anything like a perfectionist's approach.

Yet the breeders among us each have a working collection of germplasm, we could not work without one, as it is the very basis of breeding work. In other words many of us spend a part of our available capacity to the conservation of germplasm.

* Dr Bannerot, CNRA, Versailles could not attend and promised to identify some French crop specialists to become members. Nico van Marrewijk, RIVRO, Wageningen could not attend but was registered as member.

What would be our total available capacity and how is it exploited?

Unfortunately we do not know each other well enough to be able to say that there is no duplication, there may even be capacity to spare! (after all, the seeds of our crops store well), and what about efficiency? There is a need to get organised: to communicate on the subject and evolve a mild form of coordination on a voluntary basis: arrive at a division of work.

In the process we will pinpoint gaps and profitable areas in the world for collection. This we could bring to the attention of other parties whom we could advise on the best way of using the possible part of their facilities allocated to Cruciferous crops.

If the former is correct it would seem logical that our prospective 'Cruciferous gene bank organisation' working group could have for example the following objective:

To prevent erosion of germplasm of Cruciferous crops

We would want to reach the objective in a 'no-nonsense' practical, efficient, way.

I understand the term "germplasm" to mean a finite quantity of basic genetic material; genes and plasmas, not genotypes.

This quantity is susceptible to loss, the conservation of it is a special problem and requires special measures, however these are known but need to be put into action.

How could we go about it?

1. take stock of the germplasm we have.
2. take stock of the conservation capacity available.
3. what does the interaction of 1 and 2 look like?
4. what is the administration going to be like?
5. how big is the 'finite quantity' of germplasm we want to save?
6. conservation capacity is going to be the limiting factor, how can we be efficient?
7. what are the gaps, where in the world, should we collect?
8. identify the opportunities for collection.

There is a big job to be done, how can we put structure in it so that we can see clearly with what to start and how to go about it?

We should deal carefully with the problem of the exchange of materials. Most of us are either directly or indirectly in a competitive position. We are not charitable organisations, we plan to tackle this job because we feel that we, and subsequently agriculture production, will benefit in the end.

I think that we should only concern ourselves with populations that have not been exposed to conscious selection and recombination. If, for the sake of efficiency, we decide on a division of work, the exchange of such materials should be free between the participating parties, or should there be an exchange on a free for all basis?

The above is only my personal view as at this time .....

Hille Toxopeus'

(March 1979)

On the evening of Monday, 1 October about 50 of us sat together in the Conference room of the S.V.P. to try and take action. Also present were Dr Lamberts, director S.V.P., active genetic resources administrator; and Dr Kjellquist, director of the Nordic gene bank. As was to be expected the meeting had a somewhat chaotic character but the following summing up of what happened in the 3/4 of an hour that the meeting lasted seems fair.

- There was a strong feeling that a Group concerned with Genetic Conservation of Crucifer crops in Europe must be established now.

- The Group to be created would basically consist of crop specialists motivated to tackle the problem of the Genetic Conservation of existing facilities.

- Dr Kjellquist emphasised the potential importance of such a Group for the functioning of Gene Banks, a good liaison between them could be very productive.

- Toxopeus was requested to approach participants of the Conference to get the group together.

This was done and at noon on Wednesday, 3 October the names of the members of the Group were read to the Conference. During the final session of the Conference a statement was proposed by Dr Kjellquist, supported by Dr Lamberts, to be adopted by the Conference, which contained an appeal to the International Board for Plant Genetic Resources (IBPGR) for the creation of a worldwide working group concerned with the conservation of genetic resources of Cruciferae. The Conference decided to delegate the matter for consideration to the newly created 'Eucarpia Crucifer Genetic Conservation Group' that was to meet that evening.

The following issues were tackled during the Wednesday evening (3 October) meeting referred to in the first part of this report.

The proposed appeal to IBPGR was discussed, and subsequently adopted, the text was rewritten and is shown on the next page.

The framework was set up of a questionnaire that aims to inform us on the genetic resources of Cruciferae available amongst the members of the Group. This questionnaire will be circulated in December and could be completed this winter.

THE WORLDWIDE CONSERVATION OF GERMPLASM OF CRUCIFER CROPS

- an appeal to the International Board for Plant Genetic Resources IBPGR
- statement by the Eucarpia working group on the genetic conservation of Cruciferous crops: the 'Crucifer Genetic Conservation Group' on behalf of the 'Cruciferae 1979' Eucarpia Conference held in Wageningen on 1, 2 and 3 October, 1979.

Participants in the Eucarpia Conference 'Cruciferae 1979' represent research workers on Cruciferous crops in three sections of Eucarpia: Vegetable crops, Forage crops, Protein and oil crops.

This Conference recognises that germplasm of Cruciferous crops is rapidly disappearing and agrees that there is an urgent need to collect, maintain, evaluate and document genetic resources from both developing and developed countries.*

Accordingly the Conference strongly recommends the IBPGR to establish a global working group on Cruciferous crops to encourage and coordinate worldwide conservation of germplasm.

It is hoped that representatives of the 'Eucarpia Crucifer Genetic Conservation Group', constituted by this Conference will be involved in the IBPGR group here proposed.

The following terms of reference are suggested for the IBPGR group.

1. To assess the present known collections of germplasm, their geographical representation and their known range of variability.

2. Identify priority areas and material for collecting.

3. Suggest where base and duplicate collections should be kept.

4. Promote standardised documentation and publication of 'index semina'.

* Europe, USSR, China, Japan, SE Asia, India, Pakistan, Afghanistan, Middle East, NE Africa, USA, Canada.

Report on the Fifth Meeting of the International Clubroot Working Group held on 4th October 1979 at the SVP, Wageningen.

Cynthia J. Williamson

Much of the discussion at the Meeting centred around the evaluation of ECD (European Clubroot Differential) test results and the lack of homogeneity of some of the ECD hosts. There was a proposal that the results of Plasmodiophora brassicae population tests which have been printed in the Clubroot Newsletter should be summarised and published. P. Mattusch, G.R. Dixon and H. Toxopeus agreed to write the paper and suggested that the data could also be used to illustrate some of the problems encountered with disease indices and different cut-off points.

The lack of uniformity of results obtained using the differentials, especially the Brassica oleracea hosts continues to cause concern. H. Toxopeus suggested that until more homogeneous lines have been produced of the B.oleracea set, it would be better to use only the B.campestris and B.napus differentials in P.brassicae population characterisation.

A range of radish cultivars have been tested at Svalöf and cultivars fully resistant and fully susceptible to Swedish populations of P.brassicae have been identified; R. Jönsson agreed to work on the development of a Raphanus differential set.

Future meetings will be held annually if possible. G. Weisaeth offered to arrange a meeting at the Agricultural University of Norway in 1980, and K.G. Tate in New Zealand had offered to organise a meeting during the 4th International Plant Pathology Congress to be held at Melbourne, Australia in 1983.

MORE COMPACT HABIT IN OILSEED RAPE, BRASSICA NAPUS

K.F. Thompson

Primary branches of winter oilseed rape plants make an angle with the main stem varying from 35° to 60°. Branches of adjacent plants inter-lace making it difficult to separate them at harvest and a vertical knife is attached to the windrower to cut through the crop. Pods are borne often at right angles to the main stem, but in some varieties e.g. the spring cultivar, Haplona, they may be semi-erect.

An artificial B.napus, synthesised by the Scottish Plant Breeding Station, bore pods making an angle of 30 to 45° with the main stem. In the F_2 generation from a cross with a homozygous diploid line of oilseed rape, with normal habit, two out of 150 plants had more erect pods, 15 to 25° with the main stem and branches with an angle of 30° to the main stem. Further segregation occurred in the F_3 to F_5 generations of selfing, when plants were grown in the glasshouse., By the F_5 generation a few plants had primary branches making an angle of 15° or less to the main stem and had fairly erect pods and upper leaves on the flowering stem. Inheritance of these characters are determined probably by several genes, some complementary, from both the synthetic B.napus and from the oilseed rape line. F_1 hybrids between one F_3 generation selection and an unrelated homozygous diploid line of winter oilseed rape gave intermediate values for these characteristics in comparison with the parents.

A more compact growth habit is desirable in winter rape for windrowing or direct combining the crop. More erect pods should permit light to penetrate more deeply into the pod canopy and might reduce seed and pod abortion, reported by Mendham and Scott (1975). A compact growth habit with less inter-plant competition above ground might give higher yields from higher plant populations in narrow rows. Adversely, more erect pods and compact, upright habit would offer more wind resistance, necessitating stronger straw, which might increase the loss of seed by pod shattering from inter-plant movement. This different growth habit will be backcrossed into a high yielding line to determine its advantages, if any, in the field.

It is not intended to release seed of these lines yet, because they segregate not only for degree of compactness but also for poor pod fertility and for thin, aborting pistils.

Reference.

MENDHAM, N.J. & SCOTT, R.K. (1975). The limiting effect of plant size at inflorescence initiation on subsequent growth and yield of oilseed rape (Brassica napus). J. agric. Sci., Camb., 84 : 487-502.

INTERSPECIFIC UTILIZATION OF PRODUCTIVE AND RESISTANT FACTORS IN THE DIFFERENT SPECIES OF BRASSICA FOR THE IMPROVEMENT OF THE INDIAN DIGENOMIC BRASSICA CULTIVAR.

Anubhava Narain

The Indian Brassica cultivars are toria, yellow sarson and brown sarson belonging to monogenomic rape (B.campestris) and digenomic mustard (B.juncea), all mostly spread in the northern plateau of the peninsula. Of these, the mustard being an amphidiploid of A & B genomes, is hardy, more adaptable to different regions and highly productive. It is for this reason that this group is swelling its area wherever possible through the replacement of rapes in recent years. The major constraints in pushing the frontier yields of mustard are i) lack of variability and ii) susceptibility to aphids attack. Both of these handicaps are being taken care of through interspecific breeding (amphidiploidy).

In the early sixties, as a result of evaluation of different species of Brassica against aphids under epiphytotics, the author found B.napus to be resistant and Eruca sativa and B.tournefortii tolerant. To these may be added, B.carinata which has recently shown field resistance. Direct utilization of these as cultivars could not be taken up as the exotic types of B.napus and B.carinata proved to be late and unadaptable whereas the tolerant species were deficient in productive factors. As such, cytogenetic breeding was taken up early to synthesize artificial amphidiploids of either new or cultivated species, combining both the productive and resistant factors.

For the synthesis of early maturing B.napus and B.carinata, very early maturing toria (A genome) and early kale and cauliflower (C genome) for the former and early B.nigra and early kale and cauliflower for the latter were utilised as constituents indigenous parents. The raw amphidiploid thus produced are being evaluated against mustard. In case of resynthesis of B.juncea, of the constituent indigenous parents (viz. toria, brown sarson and yellow sarson)

belonging to A genome, toria has nicked well with early B.nigra to give rise to very early amphidiploid which has the potentiality to replace toria. The other amphidiploids of juncea derived from brown sarson and yellow sarson have exhibited a broad spectrum of variability which could be utilised in breeding with natural amphidiploids for further improvement.

For the synthesis of new amphidiploids, the aphid tolerant species of B.tournefortii and Eruca sativa were tried. B.tournefortii was crossed with all possible combinations of A, B & C elementary genomes of Brassica. With the B genome (B.nigra), it was not only hybridised for the first time but also amphidiplodised. The new amphidiploid of B.tournefortii x B.nigra was reported to be B.amarifolia. It had higher fertility, dwarf size, profuse tillering, narrow flowering range and tolerant to aphids. It had, however, a little low oil content (30%) and therefore could not be pushed through. The other two amphidiploids combining B.tournefortii x B.campestris were also obtained. Due to their being cytologically very unstable, they could not lend themselves to agronomic exploitation. Thus based upon the cytological behaviour of B.tournefortii with A, B & C genomes, a new genome D has been christened to it.

The aphid tolerant Eruca sativa was crossed with B.campestris var. yellow sarson but the F_1 so obtained could not be amphidiplodised and so its agronomic evaluation could not be pursued.

It is thus clear from the above amphidiploidy breeding work that the production of amphidiploids of B.napus, B.carinata and early amphidiploids of B.juncea hold very good prospects for breeding aphid resistance and high seed yield. At present, emphasis is being laid on a large scale production of these amphidiploids for either direct utilization or through their intervarietal crosses with naturalised amphidiploids to obtain desirable derivatives.

VARIATION IN SPROUT SIZE IN BRUSSELS SPROUTS

T. Hodgkin

The proportion of the total sprout crop that falls into a particular size grade can be manipulated by adjusting plant spacing and by 'topping' as well as varying the cultivars used (Thompson and Taylor, 1973, 1974). Fisher (1974) showed that within plant differences were more important sources of variation for sprout size distribution than between plant differences in both open pollinated and F_1 cultivars. At SHRI we examined sprout growth in a number of F_1 cultivars in an attempt to discover the origin, and describe the development, of differences in sprout size on the plant.

In one experiment the weights of five sprouts from each of three zones on the stem were measured on up to eight occasions between July and December. Measurements were taken on each of ten cultivars (Leonore, King Arthur, Peer Gynt, Parsifal, Jade E, Perfect Line, Achilles, Kadina, Gleneagles and Nelson) which differed markedly for a number of production characteristics including sprout size distribution and season of maturity. Sprout weight rather than sprout size was measured because the two are closely correlated and the former is easier to measure. The zones chosen were base - positions 11 - 15 from the basal node, middle - positions 21 - 25 from the basal node and top - positions 41 - 45 from the basal node. No record was taken when the total weight of the five sprouts was less than 0.5 gm.

Highly significant differences were found for log sprout weight between cultivars, stem zones and harvest dates and there were significant interaction terms between each of these three factors. Sprouts from the basal and middle zones of all cultivars, early and late, could be weighed from the end of July. The upper sprouts were measurable only from the middle of September, except for cv. Jade E whose sprouts could be weighed by mid-August.

Sprout growth appeared to be effectively log linear for all three zones until mid-October when a marked reduction in growth rate occurred (Fig. 1). The growth rate during both phases varied according to cultivar and zone thus, for early maturing cultivars sprout growth during August and September was faster than for later maturing ones, and the slowing of growth from October onwards was more abrupt.

Middle sprouts were lighter when first recorded than basal ones but grew slightly faster and were heavier by mid-October. Those at the top, while growing faster than those from the other zones, remained lighter than them at all harvests, making little growth after mid-October.

Two cultivars, cv. Jade E and cv. Achilles, were known to have the least variable sprout size distribution and examination of sprout growth in the three zones suggested two possible explanations. Firstly, sprouts from the top zone developed slightly earlier than in the other cultivars of comparable maturity, and secondly there was less tendency for sprouts in the middle and basal positions to continue growing in the winter months (Fig. 2).

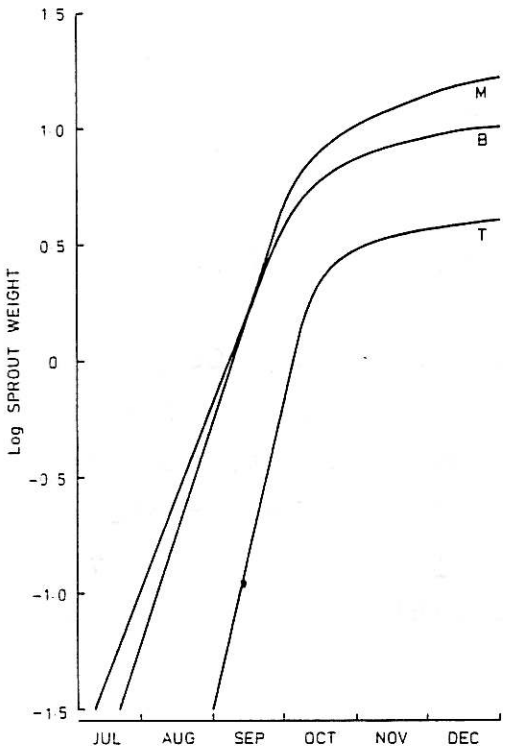


Fig. 1 Log sprout weight from three different zones on the stem. B - bottom zone, M - middle zone, T - top zone.

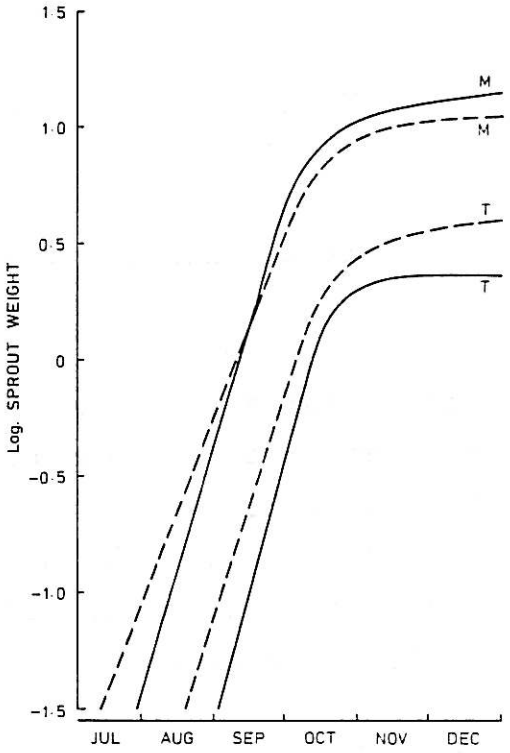


Fig. 2 Log sprout weight from two different zones on the stem for cvs. with a uniform (---) and non-uniform (——) sprout size distribution.

The two cvs. with the most uniform sprout size distribution were also those with a high number of nodes at which sprouts could develop, and it may be that these two characters are interrelated. In a cultivar with a high node number, nodes 41 - 45 are produced earlier than in one with a low node number, and sprout development can therefore begin earlier at these positions. The larger number of nodes at which sprout growth occurs may also limit the amount of growth possible at any one node, particularly in the less favourable growing conditions of autumn, thus limiting the size increase of lower sprouts.

References

Thompson, R. & Taylor, H. (1973). The effects of population and harvest date on the yields and size grading of an F_1 hybrid and an open-pollinated Brussels sprout cultivar. Journal of Horticultural Science 48 : 235-246.

Thompson, R. & Taylor, H. (1974). Effects of spatial arrangement on the yield and size grades of Brussels sprout cultivar Peer Gynt. Journal of Horticultural Science 49 : 171-181.

Fisher, N. (1974). The effects of plant density, date of apical bud removal and leaf removal on the growth and yield of single harvest Brussels sprouts (Brassica oleracea var. gemmifera D.C.) II Variation in bud size. Journal of Agricultural Science Cambridge 83 : 489-496.

CHANGES OF CHEMICAL COMPOSITION IN SOME BRASSICA SPECIES

M.Balicka, B.Barcikowska, W.Młyniec, L.Szyld

In the year 1979 seeds of more then 1000 plants were investigated with the gas-chromatography method, analysing saturated fatty acids content. According to the results obtained untill now, in M_3 of the Polish low erucic winter rape variety Janpol /Brassica napus L./, there have appeared 9 forms with changes in linoleic- and linolenic acid content /Table 1/.

Table 1. Linoleic- and linolenic acid content in M_3 of winter rape /B.napus L./ cv.Janpol

No. of plant	Mutagenic treatment	Percentage of fatty acids	
		linoleic	linolenic
B_1-2/5	NMH 3mmol 2h	30,9	24,7
B_1-2/28	" " "	27,4	13,9
B_1-2/32	" " "	31,7	13,5
B_1-5/7	EMS 0,2% 8h	12,4	6,7
B_2-1/39	" 0,5% "	16,0	6,0
B_3-5/54	" 0 " 4h	15,2	6,8
B_3-9/34	" 0,2% "	27,9	11,2
B_3-9/48	" " "	28,6	16,3
B_3-11/22	NMH 3mmol 2h	28,3	14,5

These forms are forseen as the components in reciprocal crossings, the aim of which is to obtain new recombinants with two desired characters: high linoleic - and low linolenic acids content.

Simultaneously there will be done the quality characteristics of seeds chemical composition of vigourous F_3 hybrid plants, derived from the crossings between different summer and winter forms of Brassica campestris and Brassica napus.

Of particular interest are hybrids obtained from crosses between B.campestris ssp. pekinensis, which is characterised by lower glucosinolates content and B.campestris ssp. trilocularis cv.Yellow Sarson, with yellow seed coat colour, higher protein and fat content and lower than black colouredseed coat - content of fibrin. Also interesting are forms combining great vigour in green mass productivity of B.campestris ssp. pekinensis and low glucosinolates content of B.napus cv. Bronowski.

ISOZYMES AS GENETIC MARKERS IN BRASSICA

M.B. Coulthart and K.E. Denford

Structural relationships between the "a", "b" and "c" diploid genomes of Brassica remain incompletely clarified. Detailed karyotypes are not obtainable with present techniques, and meiotic pairing in hybrids provides only ambiguous information on chromosome homology, especially with the "stickiness" and low synaptic frequency of meiotic chromosomes in Brassica (10).

However, various types of indirect evidence have led to hypotheses outlining general structural relationships between the genomes. Several early workers concluded that B. nigra, B. oleracea and B. campestris are of polyploid origin and that chromosome losses from an ancestor with n=10 or n=12 account for the aneuploidy (reviews in (7) and (11)). More recent investigators have adduced additional evidence for polyploidy, and where sufficient data were available, most of these have proposed a base number of 6 (2, 5). Finally, studies of morphology and association of pachytene chromosomes (5, 8) have allowed the postulation of formulas for the three genomes: a = AA B C DD E FFF; b = A B C DD EE F, c = A BB CC D EE F.

To have a set of gene markers for the various chromosome types in the diploid Brassica genomes would be very useful, especially if variation in phenotype resulting from variation in the marker genes reflected the degree of chromosome duplication present. Not only would such markers be valuable for basic studies of genome relationships, but also would they presumably find applications in breeding programs.

The most reliable candidates for genetic markers are enzymes, usually detected and studied by "zymogram" analysis of isozymes separated by gel electrophoresis (3). This approach has been applied with great success in other systems, where the object was to locate specific genes on specific chromosomes (1). The present authors have initiated a preliminary study of a variety of types in B. oleracea, B. campestris and B. napus, using "disc" electrophoresis. Analysis was carried out on extracts of first true leaves of diploid and autotetraploid B. oleracea var. acephala ('Marrow-stem Kale'), diploid and autotetraploid B. campestris ssp. chinensis, and artificial B. napus derived from hybridization of the two autotetraploid stocks. In this way, enzyme banding patterns were obtained for: alcohol dehydrogenase (ADH); glutamate dehydrogenase (GDH); isocitrate dehydrogenase (IDH); glucose-6-phosphate dehydrogenase (G6PD); phosphoglucose isomerase (PGI); phosphoglucomutase (PGM); superoxide dismutase (SOD); glutamate-oxaloacetate transaminase (GOT); peroxidase (Per); leucine aminopeptidase (LAP); esterase (Est); catalase (Cat). These enzymes appear from banding patterns to be coded by a minimum of 22 gene loci, and as many as 28 may be involved. Reliable cases of plant-to-plant allelic variation in enzyme mobility ("allozymes") have so far been detected in PGM, GOT, Per, LAP and SOD, and it is fully expected that larger samples will reveal allozymes of several other enzymes in the group as well.

Simultaneous analysis of several of these enzymes with the disc electrophoresis gel and buffer system in slab format has allowed more rigorous comparisons to be made between individuals, types and species. Relative banding intensities associated with allelic variants in these analyses suggest that genes for SOD are on chromosomes which are disomic in B. oleracea and multisomic in B. campestris. One of the loci for PGM is present in normal diploid dosage in B. campestris, but lack of allozymic variation in B. oleracea has not yet allowed this comparison of the two species to be made. GOT appears to have a locus present on a disomic chromosome in B. campestris and on a multisomic chromosome in B. oleracea.

Extension of samples sizes and number of enzymes analyzed should generate more hypotheses of this type, which could then be followed by e.g. linkage analyses to give a clearer picture of the structural relationships of the a and c genomes.

Not all enzymes examined in this way would be expected to reflect Röbbelen's genome formulas. His scheme was based largely on morphology of centromere regions, and more or less extensive translocational rearrangements may have distinguished the putative n=6 ancestors, or may have occurred since the supposed polyploidization event or events which gave rise to the a, b and c genomes. In this case, different levels of duplication for a general chromosome type in the a and c genomes may not imply different levels of duplication for specific homologous gene blocks. Furthermore, duplicate genes are often presumed to be subject to "relaxed" selection pressure for maintenance of original function (4), or even to be under positive selection for repression (6). These altered selection pressures may lead to loss of expression of some duplicate genes in polyploids, resulting in an imprecise relationship between chromosome dosage and active gene dosage. There is some circumstantial evidence that such repression of genetic information has occurred in B. napus (9).

Acknowledgements

The above study is supported by a NSERC of Canada Grant (A-6663) to K. E. Denford. Gratitude is extended to Drs. S. Ellerström and G. Olsson of the Swedish Seed Association (Svälof), for their generosity in providing seed of the autotetraploids and artificial B. napus.

Literature Cited

(1) Hart, G. E. 1977. Chromosomal location and evolution of isozyme structural genes in hexaploid wheat. Heredity 39: 263-277.

(2) Kamala, T. 1976. Interspecific hybrids in Brassica. Cytologia 41: 407-415.

(3) Markert, C. L. and F. Møller. 1959. Multiple forms of enzymes: Tissue, ontogenetic and species specific patterns. Proc. Nat. Acad. Sci. U.S. 45: 753-763.

(4) Ohno, S. 1970. Evolution of Gene Duplication. Springer-Verlag, New York.

(5) Röbbelen, G. 1960. Beiträge zur Analyse des Brassica Genoms. Chromosoma 11: 205-228.

(6) Schwartz, D. 1966. The genetic control of alcohol dehydrogenase in maize: Gene duplication and repression. Proc. Nat. Acad. Sci. U.S. 56: 1431-1436.

(7) Sikka, S. M. 1940. Cytogenetics of Brassica hybrids and species. J. Genet. 40: 441-509.

(8) Venkateswarlu, J. and F. Kamala. 1971. Pachytene chromosome complements and genome analysis in Brassica. J. I. B. S. 50A: 442-449.

(9) Verma, S. C. and H. Rees. 1974. Nuclear DNA and the evolution of allotetraploid Brassiceae. Heredity 33: 61-68.

(10) Wills, A. B. 1966. Meiotic behaviour in Brassiceae. Caryologia 19: 103.

(11) Yarnell, S. H. 1956. Cytogenetics of the vegetable crops. II. Crucifers. Bot. Rev. 22: 81-166.

GLUCOSINOLATE DERIVATIVES OF TURNIPS AND RUTABAGAS DURING DEVELOPMENT

H.Y. Ju, Calvin Chong, and B. Bible

Cruciferous plants contain glucosinolates which yield various hydrolytic derivatives such as thiocyanates, isothiocyanates and related products known to be potential goitrogens. Previously (1), we described studies pertaining to factors (environmental conditions, stages of development, origin of plant parts, cultivars) influencing content of thiocyanate ion (SCN^-) in various cruciferous vegetables. In a continuing study we examined the variation of SCN^-, OZT (5-vinyloxazolidinethione, goitrin), and isothiocyanates in edible (root) tissue of turnip (cv. Tokyo Cross and Snowball) and of rutabaga (cv. Altasweet and The Laurentian) during various stages of development.

The SCN^- content in turnips and rutabaga root tissues were highest during the cotyledon stage of development, then decreased thereafter as in radishes (2). The contents of OZT and isothiocyanates were generally low, but these constituents increased during the early stages of development. The contents of SCN^-, OZT, and isothiocyanates were higher in plants grown on muck soil than in those grown on mineral soil. As indicated by gas liquid chromatography, phenylethylisothiocyanate was the major isothiocyanate occurring in both turnips and rutabagas. Interestingly, a survey of 10 turnip and 5 rutabaga cultivars revealed that there was one cultivar, Hybrid Petite White, which contained no OZT.

Special appreciation is extended to Dr. W.J. Mullin of the Food Research Institute, Agriculture Canada, Ottawa for assistance with the analytical techniques and to Dr. J.D. Jones of the same institution for supplying us with myrosinase used in these studies.

References

1. Chong, C. and B. Bible. 1978. Cruciferae Newsletter No. 3, pp. 24-25.

2. Chong, C. and B. Bible. 1974. J. Amer. Soc. Hort. Sci. 99:159-162.

STUDY OF SEED DORMANCY AT EHIME UNIVERSITY

S. Tokumasu

In Plant Breeding Laboratory of Ehime University, Japan, the dormancy of Brassica seeds has been studied.

(1) The relation between dormancy and humidity during seed storage

The dormancy of Brassica seeds usually disappears in several weeks or in several months after harvest. If freshly harvested seeds of B.japonica are stored in the desiccator, the dormancy continues for several years. The dormancy of such desiccated seeds is partial or incomplete, and their percentage germination shows a considerable fluctuation during the period of prolonged dormancy (Tokumasu 1970). Next, not only B. japonica but also other Brassica and Raphanus species were tested. If seeds of each species are stored in either desiccated or wet condition after harvest, the removal of dormancy is delayed as compared with air-dry condition. It is assumed that each species has its own optimum humidity for the removal of seed dormancy. In most species the optimum might be in air-dry condition. In B.napus, however, the removal of dormancy is hastened by dry storage. The optimum humidity is in more desiccated condition than in air-dry condition (Tokumasu 1971). In order to determine optimum humidity for the removal of dormancy, seeds of B.japonica, B.cernua and B.napus were stored under different humidity conditions. The optimum humidity lies within the range of RH 40 - 70% for B.japonica, RH 30 - 40% for B.cernua, and RH 5 - 40% for B.napus. If seeds are stored under drier or wetter conditions than optimum one, the removal of dormancy is prevented semi-permanently. The effect of desiccation and moistening of seeds during storage is not to 'induce' or 'deepen' dormancy, but only to 'prolong' or 'maintain' it (Tokumasu et al. 1975).

(2) The effect of preservation of seeds in harvested fruits

In B.napus and B.cernua fresh seeds lost their dormancy in 3 months when they were separated from fruits immediately after harvest, whereas seeds showed the prolongation of dormancy for as long as more than 2 years when they were preserved in harvested fruits. In B.japonica, such prolongation effect of fruits upon seed dormancy was not observed (Tokumasu 1975).

(3) Seasonal periodicity of the loss of dormancy of imbibed seeds

In B.japonica and B.cernua, freshly harvested seeds sown in petri dishes continued to be in a non-germinating state after the first flush of germination of non-dormant seeds. Such non-germinating (dormant) seeds in imbibed condition germinated sporadically during several years. Under constant 25°C, the imbibed seeds in both species showed a unimodal distribution of germination in time. Under fluctuating room temperature, the distribution of seed germination was characterized by high peaks which occurred in every summer. The periodicity of germination is, therefore, exogenous (Tokumasu 1977).

After the publication of the above works, the following additional findings were obtained. (1) The optimum humidity for the removal of dormancy in B.carinata lies within RH 30 - 50% (1975). (2) The seasonal periodicity of imbibed seeds in B.napus was more clearly shown than in B.japonica and B.cernua (1979). At present the study of dormancy of Brassica seeds is carried on in combination with different humidities and different temperatures.

References: Tokumasu, S. 1970. J. Japan. Soc. Hort. Sci. 39, 169-177; Tokumasu, S. 1971. Ibid. 40, 23-28; Tokumasu, S., M. Kato & F. Yano. 1975. Japan. J. Breed. 25, 197-202; Tokumasu, S. 1975. Scientia Horticulturae 3, 267-273; Tokumasu, S. 1977. Ibid. 6, 101-106.

EARLINESS OF FLOWERING IN WINTER AND SUMMER RAPESEED

A.M.Olivieri and P.Parrini

In Northern Italy, rapeseed is usually sown in autumn using winter varieties. When summer types are used in this season a lower yield and an earlier flowering are observed.

As far as flowering time is concerned, varieties for Italian environments have to be: 1) early at the begining of flowering; 2) of long duration in flowering; 3) ripe at the end of June in order to allow the sowing of a second crop.

With this preliminary study we intend to gather informations about the earliness in 24 zero-erucic varieties and their progenies.

Eight summer and 13 winter varieties (Table 1) were crossed, according to a diallel scheme, in spring 1978 and, in autumn of the same year 10 plants per progeny were reared in the open field in two replications. Earliness was expressed as number of days from April 1st.

Data reported in Table 1 show that all summer varieties were earlier than winter ones with the exception of Dolora and Wanda. Almost all the progenies involving a summer parent were as early as their summer parental type indicating that earliness is dominant to lateness. Progenies involving Dolora and Wanda were as early as, or earlier than, their respective parents.

With the exception of Eragi, all the progenies obtained from winter varieties were, on the average, later than their parental type, but some progenies were earlier.

Both general and specific combining abilities are significant and the variances (Vr) and covariances (Wr) were calculated according to Mather and Jinks (Table 1). The Wr/Vr regression line, $Wr = 6.17 \pm 0.72\ Vr$ is significant, but the slope 0.72 ± 0.057 is different from unity. This means that additive,dominance and other effects are present. Since not selfed plants were used, heterozygosity could be present in some parents such as Dolora and Wanda. The low values of Vr and Wr in Midas, Esora, Kosa, Oro, Zephir and Cresor; their similarity and their clear cut with other varieties should also mean that a single gene controls the earliness.

References:

Mather K. and J.L.Jinks. 1971. Biometrical Genetics. Chapman and Hall Ltd. London.

Parrini P. and G.Mosca. 1976. First results with oil rape varieties in Veneto. (in Italian). Sementi Elette,Bologna, XXII, 75-83.

Table 1. Earliness of winter and summer rapeseed varieties and their progenies and variances (Vr) and covariances (Wr) calcula - ted according to Mather and Jinks.

Variety	Parent	F_1		Vr	Wr
		Average (1)	Range		
Winter types:					
Eurora	13.3	17.6 ϕϕ	14.4 23.8	22.8	25.4
Primor	12.9	16.0 ϕ	11.0 25.4	25.0	26.9
Lesira	12.9	19.1 ϕϕ	10.6 24.3	34.5	31.4
Gira	21.4	20.7 n.s.	14.9 25.9	17.4	19.9
Kara I	11.8	17.8 ϕϕ	13.4 23.2	16.1	20.3
51/74	17.9	16.2 n.s.	9.6 21.6	22.5	25.4
Eragi	24.8	21.5 ϕ	15.5 26.5	32.3	28.3
Status	10.4	15.4 ϕϕ	10.2 25.7	20.6	18.4
Brink	12.8	16.5 ϕ	11.0 21.0	17.0	19.7
Sano	17.3	19.0 n.s.	12.9 31.3	23.0	25.4
Girita	14.3	20.4 ϕϕ	11.4 29.4	29.1	23.3
Sinera	21.4	20.4 n.s.	12.3 31.3	33.1	27.4
Ramses "0"	14.7	15.3 n.s.	9.6 20.2	14.7	18.1
Mean	15.8	16.7	9.6 31.3		
Summer types:					
Midas	5.2	6.6 n.s.	4.5 10.2	7.2	9.9
Esora	3.5	6.6 ϕ	4.7 9.6	8.3	11.0
Kosa	6.2	6.5 n.s.	3.9 9.6	8.6	10.5
Dolora	20.8	9.2 ϕϕ	6.3 16.3	31.4	27.5
Oro	5.3	6.7 n.s.	3.9 9.8	6.1	10.9
Zephir	6.7	7.1 n.s.	4.9 9.5	9.1	8.7
Wanda	11.1	8.0 ϕ	4.5 11.1	20.2	22.9
Cresor	6.3	7.3 n.s.	5.4 12.5	7.9	12.5
Mean	8.1	7.3	3.9 12.5		

(1) n.s. = not significant;
ϕ = significant at P=0.05;
ϕϕ = significant at P=0.01 the difference between the F_1 average and the parental value.

SCREENING FOR RESISTANCE TO BLACKLEG OF CRUCIFERS IN THE SEEDLING STAGE

P. A. Delwiche and P. H. Williams

The occurrence of the blackleg disease, caused by Phoma lingam, on cabbage (Brassica oleracea var. capitata) and more recently on rapeseed (B. napus var. oleifera) in North America, Europe, and Australia has stimulated interest in the search for genetic resistance to the pathogen. Resistance has been identified in French B. napus breeding lines and is being incorporated into commercial rapeseed cultivars, although the mode of inheritance and degree of specificity of that resistance are poorly understood. The relationship of P. lingam isolates from different host species is also uncertain, although some evidence for host specificity of the pathogen is available.

In order to assist breeders in efficiently selecting resistant material from large numbers of breeding lines, and to facilitate the study of inheritance of resistance, a screening prodedure was developed which permits the differentiation of resistant from susceptible phenotypes in the seedling stage. The procedure involves wounding the cotyledons of 5-day-old plants and placing a drop of inoculum consisting of 10^5 pycnidiospores in water over the wound. Each cotyledon is wounded at 2 sites and is inoculated with 2 different isolates. After 10 days at 21°C, each plant is evaluated for its response to each of the 4 isolates. Evaluation is based on lesion size and degree of tissue blackening and collapse.

Using this procedure, we have been able to demonstrate the specificity of P. lingam isolates for hosts within the genus Brassica. Isolates of the fungus from B. oleracea and B. napus, indistinguishable morphologically or otherwise, are distinguishable in their effects on B. oleracea and B. napus hosts: rape seedlings are susceptible to rape isolates and resistant to cabbage isolates, while cabbage seedlings are susceptible to cabbage isolates and resistant to rape isolates. These results suggest that effective screening for Phoma resistance in B. oleracea or B. napus must be carried out using fungal isolates from the corresponding host.

The response of several rapeseed cultivars to the same inoculation procedure with several pathogenic rapeseed isolates demonstrated the occurrence of differential resistance to the various isolates. None of the B. napus lines tested thus far is uniformly resistant or susceptible to all isolates. Table 1 summarizes the results of inoculating 4 cultivars with 6 isolates. "R" and "S" indicate that all the plants in a given cultivar are, respectively, resistant and susceptible, to a given isolate, and "R/S" indicates that a cultivar segregates, with respect to a single isolate, for resistant and susceptible phenotypes. These results suggest that there is a considerable degree of specificity between host and pathogen, and that the French resistant germplasm may not be effective against German or Australian populations of the pathogen if different virulence genes are present in those populations than in French populations. We recognize, however, that the conditions of this seedling test favor the identification of specific resistance, and that non-specific resistance may be present in existing cultivars, but unrecognizable under these test conditions. Whether the highly specific resistance that is apparent in these seedling tests in also expressed under field conditions has not yet been determined.

TABLE 1. RESPONSE OF 4 CULTIVARS TO 6 P. LINGAM ISOLATES

	R39	PRIMOR	LESIRA	GIRITA
BR2	R/S	S	S	R/S
UR5	R	R/S	S	R/S
RR18	R/S	S	S	R/S
RR13	R/S	S		R/S
ER2	R	S		S
BiR1	R	R		S

BLACKLEG (LEPTOSPHAERIA MACULANS) IN NEW ZEALAND OILSEED RAPE

J. Lammerink

Spring sown oilseed rape has been grown commercially in New Zealand since 1974. The crop has been mainly confined to the Southland and Canterbury districts of the South Island. Because of favourable climatic conditions seed yields in Southland have been high. Blackleg has not yet been a problem despite the close proximity of infected swedes. Swedes are an important fodder crop in Southland and dryrot, which is also caused by L. maculans is a very common disease of Southland swedes.

In Canterbury yields of spring-sown oilseed rape have been lower and more variable than in Southland due to moisture stress and infestations by cabbage aphids (Brevicoryne brassicae) which can be devastating when irrigation or aphid control are not applied. However blackleg has not been a problem.

Autumn-sown biennial rapeseed was therefore expected to be a more reliable crop in Canterbury. Because no suitable cultivars with low levels of erucic acid in the oil and of glucosinolates in the meal were available, a breeding programme has been in progress at Lincoln for the last eight years. In 1977/78 some "double zero" F4 selections were very promising both in yield and oil content, while no disease problems were observed. However in 1978/79 after an exceptionally wet winter blackleg or basal stem canker was identified for the first time in field trials of our autumn sown breeding material. The incidence was high in the low-glucosinolate selections and many plants were lodged or broken off at the base. The high-glucosinolate cultivars Jet neuf, Rafal and Primor had very low infection rates and no plants lodged.

Naturally the epidemic provided an opportunity for selecting presumably resistant plants, which are now being progeny-tested.

KIRI, A NEW SWEDE CULTIVAR WITH CLUBROOT RESISTANCE DERIVED FROM TURNIP

J. Lammerink

Kiri is the result of a breeding programme conducted by R.W. Hart and myself in which clubroot resistance was transferred from turnip (Brassica compestris) to swede (B. napus). The turnip cultivar was Debra, which was resistant to all races of clubroot identified in New Zealand. The breeding technique was described by J. Lammerink (1970) in New Zealand Journal of Agricultural Research 13: 105-10 and the agronomic value by R.W. Hart and J. Lammerink (1978) in N.Z. Journal of Agriculture 136: 52.

Clubroot resistant oil-seed rape

S. Gowers

Clubroot resistance has been transferred from European Clubroot Differential 04 into oil-seed rape. Hybrids from oil-seed rape crossed with ECD 04 were backcrossed to the rape parent, and the progeny were tested for clubroot resistance. The clubroot population used was coded 18/31/31, and resistant plants of class 0 were selected.

	Resistance Class					
Oil-seed rape parent	0	1	2	3	4	Total
Norde	1	-	-	-	-	1
Rapol	3	1	-	-	4	8
Lesire	6	-	-	-	21	27
Primor	9	2	-	-	16	27

Chromosome counts were obtained from 14 of the resistant plants, and, although no 38 chromosome plants were obtained directly from the backcross, a high proportion had 36 or 37 chromosomes.

	Chromosome Number					
Rape parent	32	34	35	36	37	Total
Norde				1		1
Rapol				2	1	3
Lesire				2		2
Primor	1	1	1	2	3	8

The selected plants were self-pollinated, and the five most fertile lines were tested for clubroot resistance against a population coded 20/31/31.

		Resistance Class of Progeny					
Rape parent	Chrom. No.	0	1	2	3	4	Total
Norde	36	26	8	4	4	7	49
Rapol	37	30	13	0	2	9	54
Lesire	36	11	10	2	3	11	37
Primor (1)	37	32	8	0	6	8	54
Primor (2)	37	30	7	2	3	6	48

Selections of resistant plants were made for all lines, but only those from the 37 chromosome parents were screened for chromosome number; from 90 plants scored, 26 had 38 chromosomes. The procedure adopted was designed to maximise the proportion of 38 chromosome plants obtained from cytological screening. From a total of 104 plants screened (14 + 90), a success rate of 25 per cent has, therefore, been achieved.

The inheritance of resistance in the lines is uncertain, as the segregation ratios obtained do not fit those expected in some cases. In the test of the backcross material, less than the expected 50% resistant plants were obtained; this was mainly due, however, to the results of the Lesire line. In the next generation, a 9/16 proportion of resistants should be obtained if the parents inherited both the resistance genes expected to be necessary for resistance to a

20/31/31 population. Considering class 0 to be resistant, there is a good fit except for the Lesire line again. If class 1 plants were considered resistant, the Lesire results would fit the 9/16 ratio, but the others would then give far too high a proportion of resistants. These expectations, however, are based on the reactions of the B.campestris differentials to the Dutch populations of this classification, and, although giving similar scores, the populations used may differ in virulence genes.

Acknowledgements

Thanks are due to: D. Page and Dr C.J. Williamson for clubroot testing; J. Fantes and A. Wilkinson for chromosome counts; D. Barclay for pollinations etc.

Propagation of Clubroot Tolerant Cauliflower Plants

Shigemi Honma and Dennis Werner
Department of Horticulture
Michigan State University
East Lansing, Michigan 48824 USA

Losses of cauliflower plants selected for clubroot tolerance in the greenhouse have been extremely high due to the necessity of thoroughly examining the roots for clubs at the time of selection. Use of plant stumps or placing of plants in pots for sucker formation or seed formation was always not reliable. The application to the base of the half expanded leaves removed near the curd with 2,000 and 5,000 ppm of indole butyric acid and grown in sterilized sand produced plants with roots. The leaf cuttings were misted for approximately 2 weeks or until the leaf rooted and were placed in the greenhouse. Approximately 9 weeks later plants with roots were removed for transplanting. Details of this study to appear in Scientia Horticulturae.

IMPROVEMENT OF MILDEW RESISTANCE IN THE SWEDE BREEDING PROGRAMME AT THE WELSH PLANT BREEDING STATION.

T. D. Johnston

Modern varieties of swedes exhibit a greater degree of resistance to mildew (Erysiphe cruciferarum) than older stocks, but in some years (e. g. 1976), the disease can develop to quite severe levels in crops of these grown in the more southerly parts of Britain. One of the breeding aims of the swede improvement programme at the Station is the development of new varieties with enhanced levels of mildew resistance.

The programme is partly based on a highly mildew-resistant but otherwise low value swede line (Dc 94). Some progenies of crosses following the use of this line as a parent have exhibited very good levels of resistance in the glasshouse during the hybridization and selfing season, and marked inter-line differences have been apparent in the field during the autumns of 1977 and 1978. During the present season so far virtually no mildew has appeared in the breeding fields at Aberystwyth to confirm or contradict consistency of these findings.

The following simple and convenient method of mildew susceptibility testing, using detached leaf segments (c 4-8cm^2) lying on moist filter paper in petri dishes has been employed. Segments, from fairly young but near fully grown leaves, are dusted lightly with spores from a mildew infected swede leaf. The dishes are then covered with lids and placed in a moderately cool, well lit but not sunny position or in a lighted incubator at 15^{o}C, 8-12h daylength. Moisture content of the dishes is regularly maintained, and the segments generally remain in a good state of vigour for 2-3 weeks. Mildew sporulation commences 4-5 days after inoculation on susceptible genotypes.

Experiments with this detached segment technique show clearly that marked differences occur in the rapidity and extent of pustule formation, but no hypersensitive type reactions nor complete immunity have been observed. The technique cannot distinguish variation in apparent susceptibility due to 'mechanical' factors such as erectness or waxiness of leaf surfaces, both of which could affect spore adhesion, nor variations due to sheltering of lower leaves by closely adjacent leaves of nearby plants. However, the findings of the laboratory technique generally correspond well with glasshouse and field observations.

These tests suggest, therefore, that differences between lines may be due at least in part to variations in rapidity and extent of pustule formation. If so, the lower levels of mildew intensity observed on some lines in the breeding nursery would be considerably enhanced under large-scale monoculture conditions.

ELECTRON MICROSCOPIC STUDIES ON THE ROOT HAIRS AND CORTEX OF A SUSCEPTIBLE AND A RESISTANT VARIETY OF *BRASSICA CAMPESTRIS* INFECTED WITH *PLASMODIOPHORA BRASSICAE*.

H.M. Dekhuijzen

The cortex of the roots of a susceptible and a resistant variety of *Brassica campestris* var. *rapa* infected with sterile resting spores of *Plasmodiophora brassicae* from senescent callus was studied at a stage prior to disease symptom development. Electron micrographs show the presence of amoeboid structures within the cortical cells of the susceptible variety 10 days after inoculation. Cell wall perforations, hypertrophied host cell nuclei, nucleoli and broken tonoplasts were frequently found in the susceptible variety. It has been concluded that amoeboid structures of the parasite penetrate the cell wall and disrupt the cortical cells.

Electron micrographs of the resistant variety show the presence of zoosporangia with secondary zoospores in the root hairs nine days after inoculation. Two to four days later a large number of dead host cells can be observed in the outer cortical layer of the resistant variety, whereas no apparent changes are found in the inner cortex. The results suggest the occurrence of a hypersensitive host reaction which terminates further growth of *Plasmodiophora brassicae*.

A full paper has been published in Neth. J. Pl. Path. 85, 1-7 (1979).

ATTEMPTS TO RESYNTHESIZE NATURAL ALLOPOLYPLOIDS FROM THE PREDICTED PARENTS

Walter Titz

Allopolyploidy is of great importance for the evolution of both crops and wild plants. In the case of several Brassica crops resynthesis of amphidiploids from their putative parents has been successful. However, besides that there is no natural allopolyploid in the Cruciferae that has been resynthesized by hybridization and polyploidization from its presumed parents. Besides technical reasons this is obviously due to the more complicated course of evolution in natural allopolyploids: in nature hybridization is usually followed by segregation, back-crosses and further hybridization, moreover divergent evolution might have changed the products of primary hybridization or allopolyploidization. Thus cannot be expected that natural allopolyploids are really always intermediary between their parents and that the characters of the latter could be predicted by a simple extrapolation from the morphology of the former.

The wide-spread tetraploid Arabis hirsuta (L.)Scop.s.str. (2n=32) has been supposed from morphological and chorological comparison (TITZ,1972,p.125)[1] to have originated by simple allotetraploidization from the diploids A.sagittata (Bertol.)DC. and A.ciliata Clairv. because of being ± intermediary between these two species. But recent investigations (TITZ, in preparation) revealed that this hypothesis must be abandoned for the following reasons: 1. morphological dissimilarity of the colchicine induced allotetraploid A.sagittata x ciliata and the natural tetraploid A.hirsuta s.str. especially in quantitative characters; 2. nearly complete intersterility between induced and natural tetraploids; 3. extremely reduced fertility in a spontaneous hybrid between unreduced A.ciliata x sagittata and A.hirsuta s.str., and total sterility in the back-cross of this hybrid with A.hirsuta s.str. Thus artifical tetraploid A.sagittata x ciliata is certainly not conspecific with natural A.hirsuta s.str.

---

[1] TITZ W., 1972, Taxon 21: 121-128

INHERITANCE OF SOME CHARACTERS IN RADISH (RAPHANUS SATIVUS L.)

A. BONNET

D. MADJAROVA had selected the Biser round white radish variety with glabrous leaves and yellow seeds (2), following the intergeneric cross : Raphanus x Brassica (1).

The cross of this variety with a line of round, red and white, hairy leaves and brown seeds radish was made in 1976 and the F1, F2 and BC1 generations were observed.

D. MADJAROVA had already indicated that the characters red root and hairy leaf were linked (3) ; we have discovered no one single recombinant red root-glabrous leaf. We have observed moreover that this linkage also occurs as regards stem and seed colour : only the plants with red root have a more or less anthocyaned stem and brown seed.

In our cross, the segregations agree closely enough to a simple monogenic dominant determinism, for the whole group of characters (red root, hairy leaf, red stem, brown seed). The whole F1 plants had a red root with small white tip ; the F2 and BC1 plants had only two classes : white and red with small white tip. No purple root was found, contrary to the general observations made of the progenies of crosses between red and white radishes : thus, it would seem that Biser does not possess the gene generally present in the white radishes which controls the hydroxylation of the pelargonidin to the cyanidin.

According to many writers, the red colour intensity is controlled by a cumulative effect of genes ; the backcross with the Biser white radish produced 50 % of plants with very scarlet red root having a small white tip, with better colouring than the parent line used. A breeding programme is under way with this material which has in addition root firmness, thickening of leaf blade and improved resistance to splitting and white rust (Cystopus candidus).

References

1. MADJAROVA D. and BENBASSAT E., 1968.
Some results from use of remote hybridization in the Umbelliferae and Cruciferae.
Genetics and Plant Breeding, 1, 2, 117-132.

2. MADJAROVA D., etc.., 1973.
Results of hybridization between Perla and other radish varieties.
Horticultural and Viticultural Science, 10, 8, 83-90.

3. MADJAROVA D., 1975.
Inheritance of the characters hairiness of leaf blade and root colour in radish.
Genetics and Plant Breeding, 8, 5, 365-373.

POSSIBILITY TO BREED CABBAGE LINES WITH THE CYTOPLASM OF RADISH

Sarashima,M. and Y.Matsuzawa

The main objectives in our interspecific and intergeneric hybridization programme are :

1. To introduce some useful characters from a related species into the cultivated one,
2. To induce cytoplasmic male sterility for reliable seed production,
3. To develop newly synthesized vegetables.

In the present studies we have obtained some cabbage lines with the cytoplasm of radish. The mating scheme is as follows:

Origin *R.sativus* cv.Shogoin x *B.oleracea* var.acephala cv.Habotan

F1 ($2n$=18)

(Successive inbreeding from the F1 to the F13)

Raphanobrassica F14 ($2n$=36) x 4X *B.oleracea*($2n$=36)

G1 B1 6 plants($2n$=36)

B1 plants($2n$=36) x 4X *B.oleracea*($2n$=36)

G2 B2 25 plants($2n$=34 - 54)

B2 plants($2n$=38) x 4X *B.oleracea*($2n$=36)

G3 B3 2 plants($2n$=36,38)

B3 plant($2n$=36) x 4X *B.oleracea*($2n$=36)
male sterile
but cross fertile

B4 26 plants($2n$=35 - 40)

As recurrent pollen parents,some varieties of tetraploid *B.oleracea* were used so as to strike a coincidence in chromosome level of promissing nature.

In B3 a male sterile plant being $2n$=36 with failed stamen appeared, but it was cross fertile with 4X *B.oleracea* and produced 5 to 8 seeds per pod with about 85% pod-setting. The B3 plant with $2n$=36 closely resembled in feature to the tetraploid cabbage.

Seed germinating rate of B4 seeds was about 50%. The B4 Plants grown varied in morphological characters and their chromosome numbers varied from 35 to 40 in diploid state. Eighteen of 26 plants in B4 were $2n$=36 and some of them formed heads like cabbage. The ratio of male sterile plants to male fertile ones was 19 : 7.

Nowadays we are trying to get diploid substitution lines of heading cabbage showing cytoplasmic male sterility from successive back-crossing of B4 plants being $2n$=36 with diploid heading cabbage.

INHERITANCE OF SOME CAULIFLOWER CHARACTERS IN THE OFFSPRING OF THE HYBRID BETWEEN SELF-INCOMPATIBLE INDIAN VARIETY PUSA KATKI AND SELF-COMPATIBLE SUMMER VARIETY RAPID x/

Julia Hoser-Krauze, Jadwiga Gabryl

Trials conducted on the inheritance of earliness of initiation, size and market value of the curd in F_1 hybrids, and in hybrids acquired by three successive backcrosses between the Indian self-incompatible Pusa Katki variety and the selfcompatible summer Rapid variety, have proved premature formation in temperate climate of small and worthless edible curds to be governed by a single dominant gene.

In hybrids obtained as a result of three successive backcrosses with Rapid variety there was noticed a positive effect of selection and of backcrossing on the curd diameter and market value. Self-incompatible Indian Pusa Katki variety is unfit to serve as the maternal component in hybridization on account of the dominance of premature formation of non-marketable edible curds. The F_1's obtained are inferior to the summer-group varieties. The mentioned variety, though, may serve as a source of S-alleles for introducing the character of self-incompatibility into self-compatible, summer varieties.

x/ Detailed resultes are publicated in Genetica Polonica Vol 19, 1978, No4.

CHANGE OF CROSS-AFFINITY WITH PARENTAL SPECIES ACCOMPANIED WITH THE CHANGE OF FLOWER COLOUR IN BRASSICORAPHANUS

M. Kato and S. Tokumasu

Brassicoraphanus (amphidiploids between Brassica japonica Sieb. and Raphanus sativus L.) has been grown during 16 years (F_1 to F_{16}). As already reported, yellow-flowered plants occurred among originally white-flowered plants (Tokumasu, 1976). This was caused by the segmental exchange of chromosomes, resulting in crossing-over between the gene Y (yellow flower) from Brassica and the gene W (white flower) from Raphanus. The genotypes of white- and yellow-flowered plants were determined to be YYWW and YYYY, respectively, where W is dominant over Y (Kato & Tokumasu, 1976).

Relation between flower colour and fruit-set percentage.

With the purpose of obtaining nucleus-substituted plants, Brassicoraphanus was crossed with the pollen of R. sativus. As female parents, F_2 to F_{11} plants were used. As the result, a large difference in the percentage of fruit-set between white-flowered plants and yellow-flowered ones was noticed. The percentage of fruit-set of white-flowered F_2 plants was 85 %. The percentage of yellow-flowered F_3 plants was one half that of white-flowered ones (64 %). In F_4 and F_5 generations, yellow-flowered plants took the values of 8 and 3 %, respectively, whereas white-flowered ones 35 and 45 %. In F_9 and F_{11}, only yellow-flowered plants were crossed, but no fruits were obtained.

Relation between flower colour and pollen behaviour.

In order to examine cross-affinity more precisely, differently flower-coloured plants were pollinated with their parental species. The behaviour of pollen grains and pollen tubes on the stigma, in the style, and in the ovary was observed by the fluorescence microscope. When yellow-flowered F_{11} plants (YYYY) were pollinated with white-flowered R. sativus, pollen tubes were scarcely observed in the style and the ovary, and no fruits set. However, when they were pollinated with yellow-flowered B. japonica, many pollen tubes were observed in the style and the ovary, and fruit-set was 29 %.

When white-flowered plants (YYWW) were pollinated with 4x R. sativus, active pollen behaviour was observed everywhere in the pistil. In this case, 34 % fruit-set and 1.1 seeds per flower were obtained. As against this, when they were pollinated with 4x B. japonica, even pollen germination on the stigma was scarcely observed, and low fruit-set (10 %) and no seeds were obtained.

Conclusion

White-flowered plants showed much more cross-affinity with white-flowered R. sativus than with yellow-flowered B. japonica, and yellow-flowered plants showed much more cross-affinity with B. japonica than with R. sativus. These phenomena seem to give a clue to solve the problem of cross-affinity between different species. The explanation is being tried in relation to flower colour and sterile (or imcompatible) genes or gene complex.

Tokumasu, S., 1976. The increase of seed fertility of Brassicoraphanus through cytological irregularity. Euphytica 25:463-470.

Kato, M. & S. Tokumasu, 1976. The mechanism of increased seed fertility accompanied with the change of flower colour in Brassicoraphanus. Euphytica 25:761-767.

THE POP METHOD FOR OVERCOMING SELF-INCOMPATIBILITY USES LIQUID PARAFFIN

H. Roggen

A new method to overcome self-incompatibility in Brassica oleracea was presented at the Eucarpia 'Cruciferae 1979' Conference, held in Wageningen from 1 - 3 October, 1979. This method was called POP, for Paraffin Oil Pollination.

The oil used is a hydrocarbon mixture in the range C_5H_{12} - $C_{17}H_{36}$ and during discussions it became apparent that it should be referred to in English as 'liquid paraffin', rather than 'paraffin oil'.

The table of results is shown with an amended heading for clarification.

Clones of Brussels Sprouts	Open flower Self-pollinated	Bud-pollination	Liquid Paraffin pollination
1	0.0	0.6	0.4
2	0.1	3.7	0.1
3	0.5	4.5	6.3
4	0.7	0.9	2.6
5	1.0	2.9	6.9
6	1.0	2.9	3.7
7	3.3	7.7	11.5

THE PRODUCTION OF DISOMIC ADDITION LINES OF BRASSICA CAMPESTRIS.

J.A. Fantes and G.R. Mackay

This paper summarises the synthesis of lines of Brassica campestris (2n = 20 aa) possessing an additional pair of identical chromosomes derived from the c genome of B.napus (2n = 38 aacc). The method described could be used to transfer desirable characters from the c genome of B.napus to B.campestris. Since B.napus is an allotetraploid of B.oleracea (2n = 18 cc) and B.campestris (2n = 20 aa) (U.N. 1935), the method also offers the possibility of introgressing chromosomes and useful characters from B.oleracea via artificially synthesised B.napus. (Snell, 1977). In addition to these practical breeding applications the isolation of single chromosomes of the c genome will provide an opportunity for detailed genetic and karyological examination of the B.oleracea genome similar to those conducted in wheat, (Riley & Chapman, 1958).

Allotriploids (2n = 29 aac) obtained by crossing forage rape, B.napus with turnip B.campestris ssp rapifera, were backcrossed to turnip as both pollen and seed parents. The progeny were examined cytologically and out of 203 plants 22 had a chromosome number of 21. Meiotic analysis of the allotriploid hybrids had suggested that the 9 univalents of the c genome were randomly passed through the backcross and this would give rise to a binomial distribution of chromosome numbers in the backcross progeny. The results obtained are compared with the expected binomial distribution:-

	Chromosome counts											No. of progeny
	20	21	22	23	24	25	26	27	28	29	>29	
Expected frequency	0.002	0.02	0.07	0.16	0.25	0.25	0.16	0.07	0.02	0.002	0	
Observed frequency												
aac as male	0.06	0.13	0.1	0.06	0.09	0.17	0.16	0.15	0.06	0.03	0	150
aac as female	0	0.06	0.06	0.17	0.17	0.25	0.15	0.08	0	0.06	0.02	53

Many more plants with extreme chromosome numbers were found than expected; similar results were obtained when the allotriploids were backcrossed to B.napus (Mackay, 1977).

A sample of the 21 chromosome plants were analysed at meiosis. In the plants examined 93% of MI cells contained ten bivalents and one univalent; this confirms that the extra chromosome is from the c genome. 18% of cells at MII had irregular segregations with lagging chromosomes excluded from the spindle. Six of these monosomic addition lines were bud selfed in an attempt to isolate 22 chromosome plants with a pair of identical c chromosomes. The proportion of plants with 2n = 21 or 2n = 22 was much lower than expected. Assuming random segregation of the univalent and no differential viability of gametes we would have expected 2n = 22, 21, 20 plants in a ratio of 1:2:1, but in fact only 1% of plants examined were 2n = 22 and 20%

were 2n = 21. This lack of 22 & 21 chromosome plants may be caused by the observed meiotic irregularities and additionally gametes with n = 11 may have a reduced viability.

The three plants with 22 chromosomes, each derived from a different 21 chromosome parent, were smaller, less vigorous, later flowering and less fertile than 21 chromosome plants from the same parent. The 22 chromosome plants were bud selfed; meiotic data and progeny chromosome numbers are not yet available but the low seed set per pollination suggests there are fertility problems.

The extra c chromosome could not be identified by size. There were differences between the various monosomic addition lines in pairing behaviour at meiosis, seed set on selfing and proportion of 22 chromosome plants in the progeny; at least three different chromosomes are probably represented in the 21 chromosome lines. We hope to clarify this using Giemsa banding techniques to karyotype Brassica chromosomes.

REFERENCES

U, N. (1935). Jap. J. Bot 7, 389 - 452.

SNELL, C.L. (1978). In: Interspecific Hybridization in Plant Breeding. (Proceedings 8th Eucarpia Congress, Madrid, 1977) 313 - 320.

RILEY, R. and CHAPMAN, V. (1958). Heredity 12, 307 - 315.

MACKAY, G.R. (1977). Euphytica 26, 511 - 519.

Genetics of Cytoplasm in Cruciferae III
Cytoplasm of *B. campestris* var. *rapa*

OHKAWA, Y and T. SHIGA

The cytoplasmic male sterile line of *Brassica napus* ((*chi*)Isuzu) discovered by Shiga and Baba(1973) has S(Sterility inducing) cytoplasm. We are searching *Brassica* for the origin of S cytoplasm. In precious reports, 13 Asian cultivars of "AA" genome species did not have S-like cytoplasm. Out of 20 varieties having "AA" genome introduced from 11 countries outside Asia, three appeared to have S-like cytoplasm and the others did not have S-like cytoplasm (Cruciferae Newsletter 3, 1978). These three strains are *Brassica campestris* var. *rapa*. We ascertained the cytoplasm of three cultivars by using male sterile line ((*chi*)Isuzu), maintainer (Isuzu-natane) and restorer (Mutsu-natane) as testers.

We conducted several crosses as shown in Table 1, and estimated degree of male sterility from the measurement of relative position of anther to stigma, e.g. low position indicates male sterile and high position indicates fertile. Table 1 shows that I 4 was fertile. But hybrids having I 4 cytoplasm were male sterile or partially male sterile as hybrids having male sterile line cytoplasm. Otherwise, the hybrids with restorer were fertile. We estimated that I 4 had S-like cytoplasm. In the same way, Kornachers Speiserübe had S-like cytoplasm. We were unable to assess I 92. Further study is in progress.

Table 1. The degree of male sterility in hybrids between male sterile line and *B. campestris* var. *rapa*, and parents.

Cultivars or Hybrids	Relative position of Anther/Stigma						
	1	2	3	4	5	6	mean
MS		4	9				2.69
(*chi*)Isuzu	39	48	23	2			1.89
Isuzu-natane					6	34	5.85
Mutsu-natane						15	6.00
B. campestris var. *rapa*							
I 4 (New Zealand)**				5	6	2	4.77
(*chi*)Isuzu x I 4*	2	1	3	9			3.27
((*chi*)Isuzu x I 4) x I 4	2	7	6	5	3		3.00
I 4 x Isuzu*	2	2	6	5			2.93
(I 4 x Isuzu) x Isuzu	2	4	4	6			2.88
(I 4 x Isuzu) x Mutsu	--			1	7	7	5.40
I 92 (FRG)*					10	5	5.33
I 92 (FRG)					1	19	5.95
(*chi*)Isuzu x I 92*			3	5	2	5	4.60
I 92 x Isuzu*		2	1	6	5	1	4.13
I 92 x Isuzu				5	2	10	5.29
Kornachers Speiserübe (FRG)*	3	8	3				2.00
Kornachers Speiserübe (FRG)	1	2	3	1			2.57
(*chi*)Isuzu x K. Speiserübe*	3	7	3				2.00
(*chi*)Isuzu x K. Speiserübe	3	8	3	4			2.44
K. Speiserübe x Isuzu*	4	6	2	2			2.14

* in 1978, ** in 1977

DISTRIBUTION LIST FOR CRUCIFERAE NEWSLETTER

(Refer to list of interests on p~~64~~ 52 for key to code below name)

ALLISON, Dr M. J.	Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, Scotland, UK.
ANTILA, Dr S.	Lansi-Hahkiala, SF-14700 Hauho, Finland.
AREND, Ir W. van der	Nunhems Zaden b.v., PO Box 5, Haelen, Netherlands.
ASSEN, Ir J. H.	Unilever Research, Postbus 7, 6900 AA Zevenaar, The Netherlands.
BARCIKOWSKA, Dr B. 1236 bdkopr	Polish Academy of Sciences, Institute of Plant Genetics, Strzeszynska 30-36, 60-479 Poznan, Poland.
BERNER, A. 25 bc	Saatzucht Steinach, 8441 Steinach uber Straubing, Germany.
BEUSTER, Dr	Bundessortenam, Prufstella Scharnhorst, D-3057, Neustadt 1.
BIBLE, Dr B.	Department of Plant Science, University of Connecticut, Storrs, Connecticut 06268, USA.
BINNENDIJK, Ir C. M.	Enza-Zaden B.V., Postbox 7, Enkhuizen, Holland.
BIXBY, Mr K. A. 1 aghipqsu	Asgrow Seed Company, Pacific Coast Breeding Station, PO Box L, 500 Lucy Brown Lane, San Juan Bautista, California, USA.
BLACK, Prof. L. L.	Department of Plant Pathology and Crop Physiology, 302 Life Sciences Building, Louisiana State University, Baton Rouge, Louisiana 70803, USA.
BLASCO, Dr A.	Escuela Tecnica Superior de Ingenieros Agronomos, Departamento de Genetica 21, Av. Blasco Ibanez, Valencia, Spain.
BOGAERT, C. W. van der	Zelder b.v., 6595 NW, Ottersum, Holland.
BOKLIN, Dr A.	Caixa Postal 673, 13100 Campinas, SP, Brazil.

BONMAN, Mr J. M	Western Washington Research & Extension Center, Puyallup, Washington 98371, USA.
BONNET, Ing. A. 5 aeghipqu	Station D'Amelioration des Plantes Maraicheres, Domaine Saint-Maurice, 84140 Montfavet, France.
BOULIDARD, Mr L. 126 aghipqr	CRNA, Station de Genetique et d' Amelioration des Plantes, Etoile de Choisy, Route de Saint-Cyr, 78000 Versailles, France.
BOWMAN, Dr J. G. 23 dghopt	Rothwell Plant Breeders Ltd., Joseph Nickerson Research Centre, Rothwell, Lincoln, England, UK.
BRADSHAW, Dr J. E. 1 bop	Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, Scotland, UK.
BREWER, Ir J. G. 123 abcp	Sluis & Groot, PO Box 13, Enkhuizen, Netherlands.
BROKENSHIRE, Dr T. 12356 abcdghil	East of Scotland College of Agriculture, West Mains Road, Edinburgh, Scotland, UK.
BUCZACKI, Dr S. 12345 abdglprs	National Vegetable Research Station, Wellesbourne, Warwick, CV35 9EF, UK.
BUTEL, Mr J. 1234 abdfghijkptu	DSIR, Crops Research Division, Private Bag, Gore, New Zealand.
CHERMAT, Mrs M. C.	Institut de Recherche Vilmorin, La Menitre, 49250 Beaufort en Vallee, France.
CHIANG, Dr M. S. 16 aglop	St Jean Research Station, PO Box 457, St Jean,Quebec, J3B 6Z8, Canada.
CHONG, Dr C.	Dept. of Plant Science, MacDonald Campus of McGill University, St. Anne de Bellevue, Quebec, Canada. H9X 1CO
CHRISTENSEN, H. S.	J. E. Ohlsens Enke A/S, Ny Munkegard, DK 2630 Taastrup, Denmark.
CLARK, Prof. K. W. 126 bckru	The University of Manitoba, Dept. of Plant Science, Winnipeg, Manitoba, Canada.
COULTHART, Dr M. B. 12356 no	Dept. of Botany, The University of Alberta, Edmonton, Alberta, Canada. T6G 2E9

COX, Mr A. E.
23 bfkt
MAFF, ADAS, Staplake Mount, Starcross, Exeter, Devon, EX6 8PE. UK.

CREHU du, Gilles
1235 bkmopqr
Station d'Amelioration des Plantes (INRA), BP 29, 35650 Le Rheu, France.

CRISP, Dr P.
15 aegjmnops
National Vegetable Research Station, Wellesbourne, Warwick, CV35 9EF. UK.

CROUCH, Dr M. L.
3 drs
Biology Dept. - OML, Yale University, New Haven, Connecticut, 06520, USA.

CRUTE, Dr I. R.
1 aglnopt
Plant Pathology Section, National Vegetable Research Station, Wellesbourne, Warwick, UK.

DAWSON, Dr P.
A. L. Tozer Ltd., Pyports, Downside Bridge Road, Cobham, Surrey, UK.

DEKHUIJZEN, Dr H. M.
lms
Centre Agrobiological Research, PO Box 14, Wageningen, The Netherlands.

DELWICHE, Ms. Patricia
13 abdglop
Department of Plant Pathology, University of Wisconsin, 1630 Linden Drive, Madison, Wisconsin 53706, USA.

DENFORD, K. E.
Department of Botany, University of Alberta, Edmonton, Alberta, Canada. T6G 2E9

DESPREZ, M.
1 bpq
Maison Florimond Desprez, Cappele 59242, Templeuve, France.

DICKSON, Dr M. H.
1 aeopqr
Dept. of Seed and Veg. Sci., NYSAES, Geneva, New York 14456, USA.

DIXON, Dr G. R.
12356 abdghijklmop
North of Scotland College of Agriculture, Horticultural Division, School of Agriculture, 581 King Street, Aberdeen, AB9 1UD, UK.

DOBSON, Mr R
1 agl
WWREC (Western Washington Research and Extension Center), Puyallup, Washington 98371, USA.

DOLSTRA, Ir O.
12356 bcdeghinopq
Stichting voor Plantenveredeling, PO Box 117, Wageningen 6140, Netherlands.

DRESSLER, Dr O.
156 aghijlmopq
Carl Sperling & Co,m 2120 Luneburg, Hamburger Str 27, W. Germany.

ELLERSTROM, Dr S.
12356 abdo
Swedish Seed Association, S 26800, Svalov, Sweden.

EVANS, D. J.
12356 befgkoprtu
Plant Breeding Station, Dunns Seed & Grain Ltd., Hartham, Corsham, Wiltshire, UK.

FANTES, Mrs J.
Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian. UK

GABRYL, Dr J.
1 apt
Instytut Warzywnictura, Zaklad Hodowli i Genetyki, Pracownia Hodowli, ul Kosciuszki 2, 96 - 100 Skierniewice, Poland.

GOMEZ-CAMP, Prof. C
456 mnoqr
Esc. TS de Ing Agronomos, Universidad Politecnica, Madrid 3, Spain.

GOWERS, Dr S
236 abdgijopq
Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian. UK.

HAL van, J. G.
15 aghipq
c/o A. R. Zwaan & Zn b.v., Pr Mariannelaan 296, Postbox 992, 2270 AZ Voorburg, Netherlands.

HARBERD, Dr D. J.
The University of Leeds, Department of Plant Sciences, Agricultural Sciences Building, Leeds. UK%

HARDING, Mr R. A.
1 apq
Charles Sharpe & Co. Ltd., Boston Rd., Sleaford, Lincolnshire, NG34 7HA, UK.

HAWK, Dr J. A.
University of Delaware, Dept. of Plant Science, Newark, Delaware 19711, USA.

HEMINGWAY, Mr J. S.
45 acd-mprtu
Colman Foods, Carrow, Norwich, Norfolk, NR1 2DD, UK.

HENDRICKX, J. J. M.
2356 bcdglnoptu
Mommersteeg International, Postbus 1, 5250 Vlijmen, The Netherlands.

HERNANDEZ-BERMEJO, Dr J.
12345 fknr
Catedra de Botanica Agricola, ET Sup. de Ingenieros Agronomos, Universidad de Cordoba, C/Alameda del Obispo s/n, Cordoba, Spain.

HODGKIN, Dr T.
12345 akmnopqtu
Scottish Horticultural Research Institute, Invergowrie, Dundee, DD2 5DA, UK.

HOLLAND, Mr H.
Asmer Seeds Ltd., Trials & Research Branch, Rigby's Farm, Newburgh, Nr. Wigan, Lancashire, UK.

HONMA, Prof. S 156 aghiop	Dept. of Horticulture, Michigan State University, East Lansing, Michigan, 48824, USA.
HOSER-KRAUZE, Dr J.	Instytut Warzywnictwa, Zaklad Hodowli i Genetyki, Pracownia Hodowli, ul. Kosciuszki 2, 96 - 100 Skierniewice, Poland.
HUIZER, A. 16 aefghijklmopqr	Jos Huizer Zaden b.v., PO Box 2003, Rijsoord 3210, The Netherlands.
HUMAYDAN, Dr H. S. 1246 aghiloptu	Harris Seed Co., 3670 Buffalo Road, Rochester, New York, 14624, USA.
IIZUKA, Dr M.	Horticultural Department, Chiba University, Matsudo-shi 271, Japan.
IWASA, Prof. Dr S. 123456 anop	Dept. of Horticulture, Iwate University, Ueda 3-18-8, Morioka 020, Japan.
JEFFES, Mr M. R. 36 bdgpt	Germinal Holdings Ltd., Plant Breeding Station, Caythorpe Heath, Caythorpe, Grantham, Lincs. NG32 3HA.
JOHNSON, A. G.	National Vegetable Research Station, Wellesbourne, Warwick, CV35 9EF, UK.
JOHNSTON, T. D. 12356 befgikmpqr	Welsh Plant Breeding Station, Plas Gogerddan, nr. Aberystwyth SY23 2EB, UK.
JONSSON, R. 3 dglp	Swedish Seed Association, S-268 00 Svalov, Sweden.
JU, Mr H. Y.	Dept. of Plant Science, MacDonald Campus of McGill University, Ste Anne de Bellevue, Quebec, Canada, H9X 1CO.
KATO, Mr M. 123456 aopqs	Ehime University, College of Agriculture, Matsuyama 790, Japan.
KLASSEN, Dr A. J.	Agriculture Canada, 107 Science Cres., Saskatoon, Sask, Canada, S7N OX2.
KOSTER, Mr H. 1236 bcdeghijklmnopqrstu	PO Box 10024, Nakuru, Kenya.
KROEZE, H. F. 123 dfkmptu	Unilever Research, Duiven, Post Bus 7, Zevenaar, The Netherlands.

KRZYMANSKI, Prof. Dr J.
3 dopqr
Instytut Hodowli y Aklimatyzacji Roslin, Oddzial Poznansko-Gorzowski, 67 - 711 Poznan 2, ul Sieroca 1a, Poland.

LAMMERINK, J.
DSIR, Crop Research Division, Private Bag, Christchurch, New Zealand.

LININGTON, Mr S
1235 bghijohqrtu
Charles Sharpe & Co. Ltd., Boston Road, Sleaford, Lincs, UK.

MacFARLANE SMITH, Dr W. H.
Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, UK.

MACKAY, Dr G. R.
Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, UK.

McNAUGHTON, Dr I. H.
12356 bdgilmnortu
Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, UK.

MARREWYK, N.P.A. van
135 aghknopqt,
RIVRO p/a, IVT, Postbus 16, 6700 AA Wageningen, The Netherlands.

MATSUZAWA, Mr Y.
Agricultural Dept., Utsunomiya University, 350 Mine-Machi, Utsunomiya 320, Japan.

MATTUSCH, Dr P.
1-6 abcdfghk lmnpt
Biologische Bundesanstalt, Institut fur Pflanzenschutz im Gemusebau, Marktweg 60, 5030 Hurth-Fischenich, Fed. Rep. Germany.

MEDDENS, Ir F.P.S.
15 ahijpq
Nunhems Zaden, PO Box 4005, 6080 AA Haelen, Holland.

MEER, Ir Q.P.van der
IVT, Postbus 16, 6700 AA Wageningen, The Netherlands.

MERRELL, Mr E. C.
1 apqu
Ferry-Morse Seed Co., PO Box 1010, San Juan Bautista, CA 95045, USA.

MLYNIEC, Dr W.
Institute of Plant Genetics Cytogenetics Laboratory, Ul., Nowy Swiat 72, Warsaw, Poland.

MORRISON, Mr D.
The North of Scotland College of Agriculture, Crop Husbandry Division, School of Agriculture, 581 King St., Aberdeen, AB9 1UD, UK.

MORTENSEN, L. G.
35 bdefgiklmnopqrstu
Den KGL. Veterinaer-Og Landbohojskole, Landbrugets Plantekultur, Forsogsgarden Hojbakkegard, Agrovej 10, DK-2630 Taastrup, Denmark.

MULLIN, Dr W. J.	Agriculture Canada, Food Research Institute, Research Branch, Ottawa, Ontario, Canada, KIA OC6
MUNOZ, Dra C. 123456 dosu	Catedra de Botanica Agricola, ETS de Ingenieros Agronomos, Universidad de Corboba, C/Alameda del Obispo s/n, Cordoba, Spain.
MUNRO, Miss I. K.	Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, UK
NAKABAYASHI, Mr H. 1234 adkmru	Agricultural Dept., Utsunomiya University 350 Mine-machi, Utsunomiya 320, Japan.
NARAIN, Dr A. 2346 bdopqst	Division of Genetics, Indian Agricultural Research Institute, New Delhi 110012, India.
NAMAI, Dr H. 123456 abdnopqsu	Institute of Agriculture & Forestry, University of Tsukuba, Sakura-mura Niihari-gun, Ibaraki-Ken, 300-31, Japan.
NUNES, G. P.	Universide Federal de Pelotas, Faculdade de Agronomia 'Eliseo Maciel', CP 354, 96 - 100 Pelotas, RS, Brazil.
OCKENDEN, Dr D. 15 aimnopq	National Vegetable Research Station, Wellesbourne, Warwick, CV35 9EF, UK.
ODENBACH, Prof. Dr W. 12356 bcdpq	Institut fur Angewandte Genetik, Freie Universitat Berlin, FB23 WE6 Albrecht-Thaer-Weg 6, D-1000 Berlin 33, Germany.
OHKAWA, Mr Y. 3 p	Division of Genetics, National Institute of Agricultural Science, 3-1-1 , Kannondai, Yatabe-Machi, Tsukuba-Gun, Ibaragi, 300 - 21, Japan.
OLIVIERI, Dr A. M. 3 dkopr	Instituto di Agronomia, Universita degli studi, Via G. Gradenigo 6, 35100 Padova, Italy.
OLSSON, G. 12356 dklopqr	The Swedish Seed Association, Fack, S-268 00 Svalov, Sweden.
PAL, Dr A. B. 1 ap	Indian Institute of Horticultural Research,255 Upper Palace Orchards, Bangalore 560006, Karnataka State, India.

PARRINI, Dr P.	Instituto di Agronomia, Universita degli Studi, Via Gradenigo, 6 35100 Padova, Italy.
PEDERSON, Mr Chr.	A/S L. Daehnfeldt Odense, PO Box 185, DK-5100 Odense C, Denmark.
PETERSEN, Mr H. L. 3 beghikq	Royal Veterinary & Agricultural University, Dept. of Crop Husbandry, & Plant Breeding, Thorvaldsensvej 40, DK 1871 Copenhagen V, Denmark.
PICKFORD, M. A.	Twyford Seeds Ltd., Kings Sutton, Banbury, Oxon. OX17 3QW, UK.
PLUMLEY, Mr R. 1 aghijklmnopqsu	Hurst Crop Research & Development Unit, Gt. Domsey Farm, Feering, Colchester, Essex. CO5 9ES, UK.
REDFERN, A. J.	Scottish Horticultural Research Institute, Invergowrie, Dundee, DD2 5DA, UK.
REUTHER, Prof. G.	Forschungsanstalt, von Lade-strasse 1, 6222 Geisenheim, W. Germany.
RICK, Dr C. M.	University of California, Dept. of Vegetable Crops, Davis, California 95616, USA.
RIMMER, Dr S. R. 236 dghilmps	Dept. of Plant Science, University of Manitoba, Winnipeg, Manitoba, Canada. R3T 2N2
ROBAK, Mr J. gp	Instytut Warzywnictwa, 96 - 100 Skierniewice, Poland.
ROBBELEN, Prof. G 36 dmopr	Institute fur Pflanzenbau und Pflanzenzuchtung, Von Siebold Strasse 8, D-3400 Gottingen, W. Germany.
ROBBINS, Prof. M. Le Ron 12 agkp	College of Agricultural Sciences, SC Agricultural Experiment Station, Coastal Branch Station, PO Box 30158, Charleston, South Carolina 29407, USA.
ROGGEN, Dr H. 12 amqr	Institute for Horticultural Plant Breeding, IVT, PO Box 16, Wageningen, The Netherlands.

ROSS, Mrs C. 1236 b	Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, UK.
ROUSSELLE, Dr P. 356 dopq	Station D'Amelioration des Plantes, INRA, domaine de la Motte-au-Vicomte, BP 29, 35650 Lerheu, France.
SAMADDAR, Dr K. R. 1234 adghilmps	Dept. Plant Pathology, Cornell University, Ithaca, New York 14853, USA.
SARASHIMA, Dr M. 123456 abcdkopqu	Agricultural Dept., Utsunomiya University, 350 Mine-machi, Utsunomiya, 320, Japan.
SCHELLER, Dr H. 12345 bcdkp	Bayerische Landesanstalt fur Bodenkultur and Pflanzenbau, Vottingerstrasse 38, 8050 Freising, W. Germany.
SCHULTZ, Mr P. E. 1 akprtu	Nestle Enterprises Inc., Agricultural Research Centre, Read Road, Route 3, Janesville, Wisconsin 53545, USA.
SHANDS, H. L. k	Dekalb Ag—Research Inc., PO Box 480, Moorhead, Minnesota 56560, USA.
SHERF, Prof. A. F.	Cornell University, Dept. of Plant Pathology, 334 Plant Science Building, Ithaca, New York 14853, USA.
SHIGA, Dr T. 12346 adkoqu	National Center Agricultural Experiment Station, Kuriyama 1055, Yotsukaido, Inba, Chiba, 284 Japan.
SIMPKINS, Dr I. 13 djmrs	School of Natural Sciences, The Hatfield Polytechnic, PO Box 109, College Lane, Hatfield, Herts. UK.
SMITH, Mr P. 16 anops	Scottish Horticultural Research Institute, Invergowrie, Dundee, DD2 5DA, UK.
SMITH, Mr R. 1 abgklmnopqr	Elsoms Seeds Ltd., Spalding, Lincs. PE11 1QG, UK.
SMITH, Dr R. H. abr	Rowett Research Institute, Greenburn Road, Bucksburn, Aberdeen, AB2 9SB, UK.
SOBRINO VESPERINAS, E. 236 bdnpqt	Compania Espanola de Cultivos Oleaginosos SA, Cecosa, Genova 9, 4, Madrid, Spain.

STEFANSSON, Prof. B. R. 236 dghioprtu	University of Manitoba, Dept. of Plant Science, Winnipeg, Manitoba R3T 2NS, Canada.
STOLK, Miss A. H. 23 dnpqrt	Pyne, Gould, Guinness Ltd., PO Box 112, Christchurch, New Zealand.
STRINGAM, Dr G. R. 23456 dops	Agriculture Canada, 107 Science Crescent, Saskatoon, Saskatchewan, Canada. S7N OX2
SVADS, Mr H. C. 12356 befghklmpq	Agricultural University of Norway, Dept. of Farm Crops, PO Box 41, N-1432 As-NLH, Norway.
SWARUP, Dr V. 1 aghnopqtu	Division of Vegetable Crops and Floriculture, Indian Agricultural Research Institute, New Delhi 110012, India.
TAKAYANAGI, Dr K. 3 bdkru	Field Crops Division, Hokuriku National Agricultural Experiment Station, 1 - 2 Inada, Joetsu City, Niigata 943-01, Japan.
TAYLOR, Mr J. P. 13 bdopqr	Plant Breeding Institute, Maris Lane, Trumpington, Cambridge, CB2 2LQ, UK.
THOMPSON, Dr K. F. 3 dopqr	Plant Breeding Institute, Maris Lane, Trumpington, Cambridge, CB2 2LQ, UK.
TITZ, Prof. Dr W. 56 nopq	Botanisches Institut und Botanischer Garten der Universitat Wien, Rennweg 14, A-1030 Wien, Austria.
TOKUMASU, Prof. Dr S. 123456 dmopqsu	Ehime University, College of Agriculture. Matsuyama, 790, Japan.
TOXOPEUS, Ir H. 123456 bcdghiklmnopqru	Stichting voor Plantenveredeling, PO Box 117, Wageningen 6140, The Netherlands.
TSUNODA, Dr S.	Faculty of Agriculture, Tohoku University, 1-1 Amamiyamachi, Tsutsumidori, Sendai, Japan.
VIGLIOLA, Ing Agr Mrs M.	Catedra de Horticultura, Facultad de Agronomia de Buenos Aires, Av. San Martin 4453, Buenos Aires, Argentina.

WALE, Dr S, J,	Agricultural Botany Division, School of Agriculture, 581 King Street, Aberdeen, AB9 1UD, UK.
WALKER, Dr J. C.	14016 N. Newcastle Drive, Sun City, Arizona, 85351, USA.
WALLACE, Dr D. H.	Department of Vegetable Crops, Cornell University, Ithaca, New York, USA.
WATANABE, Mr E. 123456 abcghijlmnopqstu	Breeding Director, Watanabe Seed Co., Ltd., PO Box No4, Kogota, Miyagi, 987, Japan.
WERNER, Dr D.	Department of Horticulture, Michigan State University, East Lansing, Michigan, 48824, USA.
WHITEAKER, Dr G.	Alf. Christianson Seed Co, Mt. Vernon, PO Box 98, Washington, 98273, USA.
WHITEHOUSE, R. N. H. 1236 bgp	Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, UK.
WEIR, Miss J.	Botany Department, The University, St. Andrews, UK.
WIERING, D. 1 aghijlopq	Royal Sluis, Afweg 31, 6702 PD Wageningen, The Netherlands.
WIJK, A. J. P. van	D. J. van der Have B.V., Plant Breeding Station, Van der Haveweg 2, 4410 AA Rilland, The Netherlands.
WILKINS, Mr R. O. 14 aghilopqstu	Joseph Harris Co. Inc., 3670 Buffalo Road, Rochester, New York, 14627, USA.
WILLIAMS, Dr P. F. 123456 aeghilopqr	Department of Agriculture, PO Box 303, Devonport, Tasmania 7310, Australia.
WILLIAMS, Prof. P. H.	Department of Plant Pathology, 1630 Linden Drive, University of Wisconsin, Madison, Wisconsin 53706, USA.
WILLIAMSON, Dr C. H. 12345 bghijlop	Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, UK.
WILLS, Dr A. B. 146 anopqrs	Scottish Horticultural Research Institute, Invergowrie, Dundee, DD2 5DA, UK.

WISEMAN, Mrs E.
146 aopqr
Scottish Horticultural Research Institute, Invergowrie, Dundee, DD2 5DA, UK.

WOODS, Dr D. L.
Agriculture Canada, 107 Science Cresc., Saskatoon, Sask., Canada S7N OX2.

WRIGHT, Dr D.S.C.
DSIR, Crop Research Division, Private Bag, Gore, New Zealand.

YOUNG, Mr H. W.
Lembaga Penelitian Hortikultura, Lembang, Indonesia.

YUKURA, Dr Y.
1235 aghikopq
46 - 7 3 - Chome, Miyasaka, Setagaya-Ku, Tokyo, Japan.

ZANTEN, Ir J. E. Veldhuyzen van
1256 abcghinpq
c/o Sluis en Groot, PO Box 13, Enkhuizen, The Netherlands.

Organisations

Bejo Zaden B.V., PO Box 9, Dorpstraat 612, 1722 ZG Noordscharwoude, Holland.

The Secretary, Eucarpia, PO Box 128, Wageningen, Netherlands.

Commonwealth Bureau of Plant Breeding & Genetics, Department of Agricultural Science & Applied Biology, Pembroke Street, Cambridge, CB2 3BX, UK.

Library De Haaff, (Foundation for Aricultural Plant Breeding), PO Box 117 - 6700 AC, Wageningen, Netherlands. Netherlands.

Institut za Oplemenjivanje i Proizvodnju Bilja, Biblioteka Rugvica, 41000 Zagreb, Marulicev trg 5/1, Yugoslavia.

The Librarian, Instituut voor Plantenveredeling, Lawickse Allee 166, Wageningen, The Netherlands.

International Plant Breeders, Chemin de St. Marc, Cartier le Basoidalet 84120, Perluis, France.

Librarian, Plant Breeding Institute, Maris Lane, Trumpington, Cambridge, CB2 2LQ, UK.

Plant Breeding Station,
Cebeco-Handelsraad 36, Postbox 139,
8200 AC Lelystad, Netherlands.

The Librarian, Scottish
Horticultural Research Institute,
Invergowrie, Dundee, DD2 5DA,
Scotland, UK.

The Librarian, Scottish Plant
Breeding Station, Pentlandfield,
Roslin, Midlothian, UK.

Sinclair McGill Ltd., Research &
Development Department.
Plant Breeding & Trials Station,
Yonderton Farm, Dalrymple, Ayrshire, UK.

Madame L. Laterrot, Bibliothecaire,
Station d'Amelioration des Plantes
Maraicheres, Domaine St. Maurice,
84 140 Montfavet, France.

University of Western Australia,
Reid Library, Mrs K. Edwards,
Periodicals Department, Nedlands,
Western Australia. 6009

Vandenberg B.V., Pr. Julianstraat
23, Postbox 25, 2670 AA Naaldwijk,
Holland.

INSTRUCTIONS FOR THE PREPARATION OF PAPERS

R.N.H. Whitehouse and A.B. Wills

Contributions will be photocopied directly from your script so please note the following requirements:-

1. Contributions should be in English and will not be edited unless we are specifically asked to help with the presentation.

2. Scripts should be typed with single spacing on one side only of A4 paper (210 x 297 mm) leaving a 30 mm margin at both edges.

3. To aid the making of good photocopies contributors are asked to choose a typewriter and paper which give the greatest clarity and contrast.

4. Please keep your contributions reasonably short and if possible to one page. Whole pages are preferred to partly filled ones. Number consecutive pages in pencil only.

5. Papers should be headed with title in capital letters and followed by the names of author or authors leaving a space before the commencement of the paper. Addresses should be omitted as these will appear in a separate list.

6. Line diagrams and tables will be accepted only when they fit into A4 format but please keep these to a minimum. Photographs cannot be reproduced.

7. The paper should not be folded. Scripts should be sent to The Editor, Cruciferae Newsletter, Scottish Plant Breeding Station, Pentlandfield, Roslin, Midlothian, EH25 9RF, Scotland, U.K., to arrive by 30th September.

Leave 30 mm margin

Leave 30 mm margin

Key to professional interests

Genera and species

1. Brassica oleracea
2. Brassica campestris (rape)
3. Brassica napus
4. Brassica other species
5. Other genera
6. Interspecific & inter-generic hybrids

Usage

a. Vegetables and condiments
b. Fodder
c. Green manure
d. Oil and protein

Pests, diseases and weeds

e. Animal
f. Weeds
g. Fungal
h. Bacterial
i. Viral
j. Mineral

Disciplines

k. Agronomy
l. Pathology
m. Physiology
n. Taxonomy and Evolution (including resources and gene banks)
o. Genetics and cytology
p. Breeding
q. Mating systems
r. Nutrition and chemical composition
s. In vitro culture
t. Variety testing (including National Lists and Breeders rights)
u. Seeds, production and performance

Distribution List - Additions and Alterations

If you wish your name to be ADDED to the distribution list OR you wish to CORRECT the entry relating to yourself

Please fill in this form and return it to:

Mr R.N.H. Whitehouse,
Scottish Plant Breeding Station,
Pentlandfield, Roslin,
Midlothian, EH25 9RF, U.K.

Full name .....

Address .....

.....

.....

.....

If your name does not appear in the distribution list or if you wish the code for your professional interests to be altered please list your interests using the key appearing on Page 52.

Suggestions for improvements in the Newsletter or for additional subjects which might be covered by contributions:-